Sheet Metal Industries

The only Journal in the World wholly devoted to the Manufacture, Manipulation, Fabrication, Welding, Assembly and Finishing of Ferrous and Non-Ferrous Sheet and Strip

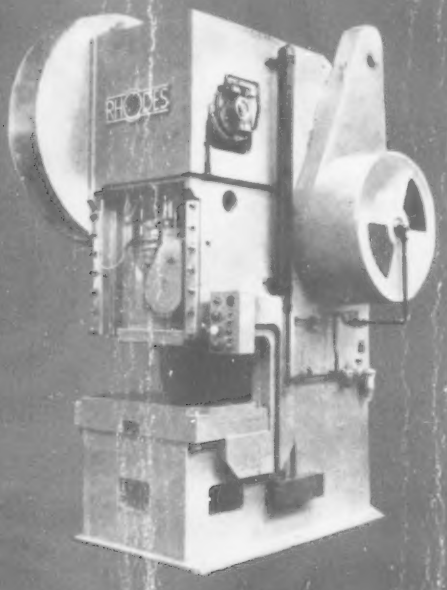
VOL. 38 : No. 416 DECEMBER 1961 PRICE 2/6

PERSONAL

I, Mr. C. FRAMEPRESS, announce my retirement owing to pressure of work. In spite of my cast-iron constitution, the stresses of modern life have finally proved too much, and I am reluctantly forced to yield under the strain.

THE TIME HAS COME !

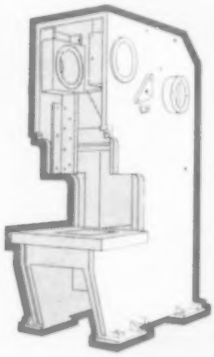
With the advent of the Rhodes steel-framed 'C-Press', the old open front press based on castings goes into honourable retirement ! We provide a one-piece fabricated steel frame which is robust, massively ribbed and stress-relieved, with a true balance of stresses under load. Famous as Rhodes presses have always been for their accuracy, we now surpass ourselves in offering maintained precision and longest tool life.



COLOSSUS OF RHODES

STEEL FRAMES INSURE AGAINST RISK OF REPLACEMENT

They are virtually indestructible, and completely solve the problem of frame breakage through overloading. Write for Publication RFP-60.



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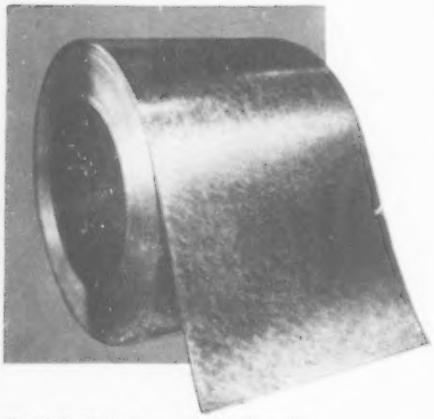

'Speltafast' is also available in coils, 2240 lbs. min.

Easy 'workability'

'Speltafast', with its tight and uniform coating, is so well bonded that it will withstand seaming and lock forming, and all stamping and drawing operations within the range of the steel base.

'Speltafast' is available in plain sheets up to 48″ wide (depending on gauge), in gauges from 18 to 32, and in lengths from 36″ to 144″. Corrugated sheets are available in various profiles.

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613-620 ROYAL EXCHANGE, MANCHESTER 2 Telephone: Deansgate 7525

DAVY-UNITED AT CONSETT

One of the modern billet rolling plants installed under the steel industry's post-war development programme is this 10-Stand Morgan Continuous Billet and Slab Mill built by Davy-United for Consett Iron Company. It is fed by a Davy-United Blooming and Slabbing Mill capable of an output of 22,000 tons a week.

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Editorial Contents: 859, 861

Classified Advertisements: 109 to 112

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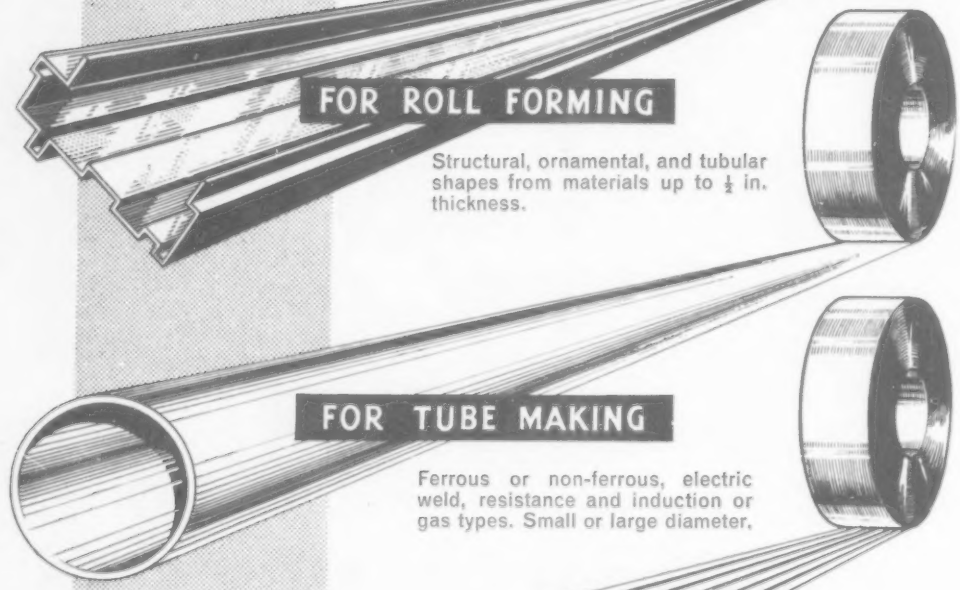
Structural, ornamental, and tubular shapes from materials up to ½ in. thickness.



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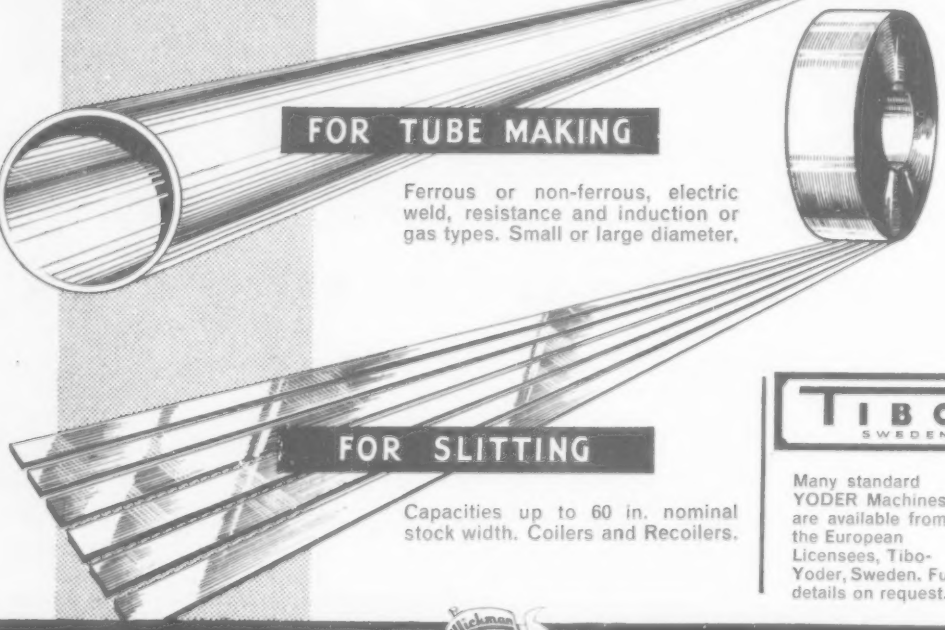
Ferrous or non-ferrous, electric weld, resistance and induction or gas types. Small or large diameter.



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Capacities up to 60 in. nominal stock width. Coilers and Recoilers.

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Many standard YODER Machines are available from the European Licensees, Tibo-Yoder, Sweden. Full details on request.

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Looks like another job for Dad—and the magic stuff he uses for putting funnels back on. Magic? Well not really, it's *solder*. It's *Fry's* solder, a subtle alloy of pure metals that make child's play of soldering and jointing. Made in lots of grades too. From the sort you use for tin funnels to the sort they solder stainless steel with, or zinc, or copper, or electrical joints or—all kinds of things.

For all kinds of solders and fluxes it's . . . .

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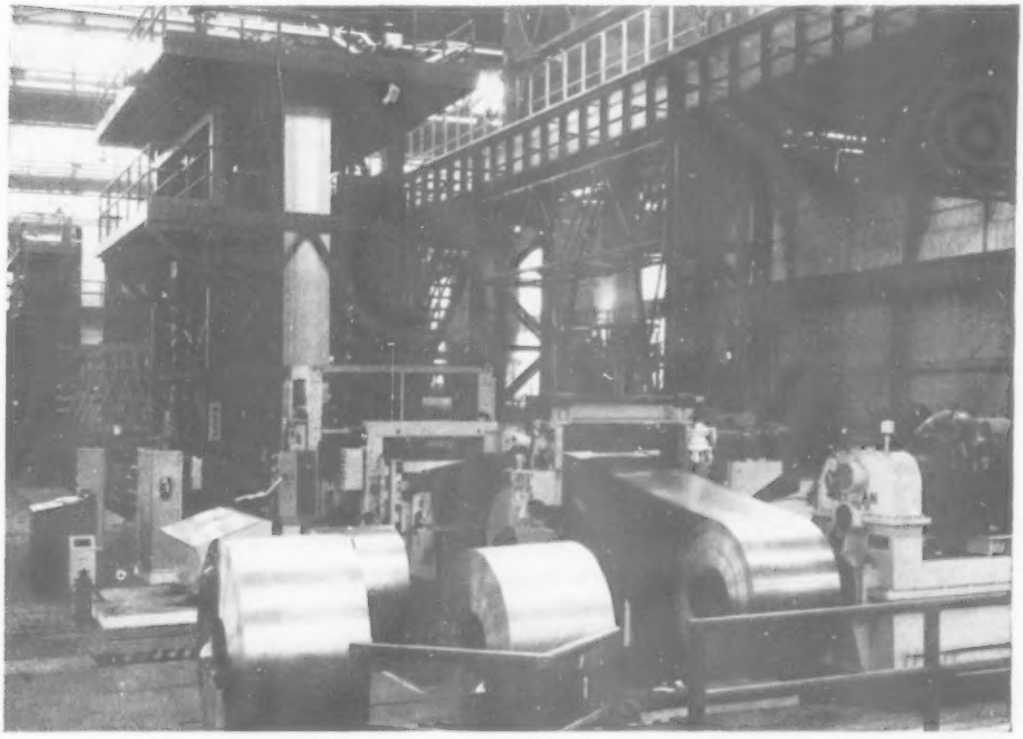
Another Electrolytic Tinning Line for Britain

The sixth Ferrostan electrolytic tinning line of Wean design to be installed in a British steelworks has now been commissioned for operation at the Trostre Works of The Steel Company of Wales Ltd.



WEAN-MILES LTD., designers and builders of equipment for British and these tinplate mills, are at present completing the engineering, manufacture and installation of new lines for:—

CONTINUOUS TINPLATE ANNEALING : CONTINUOUS STRIP PICKLING
SHEET SHEARING : SHEET SLITTING : TINPLATE INSPECTION

All this equipment is engineered and built to the designs developed by Wean, and incorporates specialized units of British design. British manufacturing facilities, labour and skill are employed throughout.

Wean-designed pickling, electrolytic cleaning, annealing, tinning, galvanizing and shearing equipment is extensively used throughout the world for processing and finishing tinplate and sheet-mill products, including stainless and silicon steels.

Their experience gained from close co-operation with the steel industries of the world for over 30 years is embodied in the equipment built in Britain by Wean-Miles Ltd.

WEAN-MILES LTD.

MOOR HOUSE · LONDON E.C.2.

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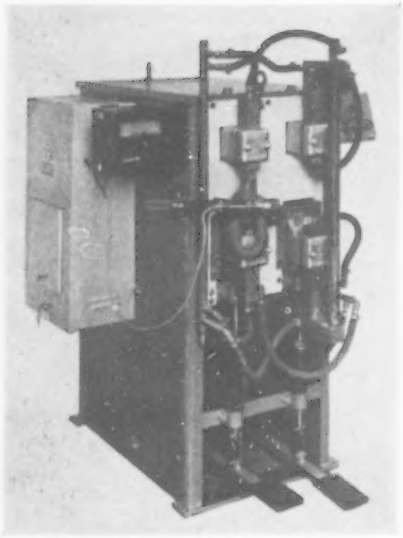
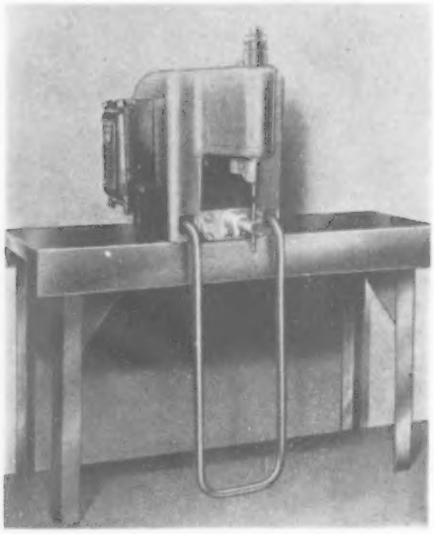


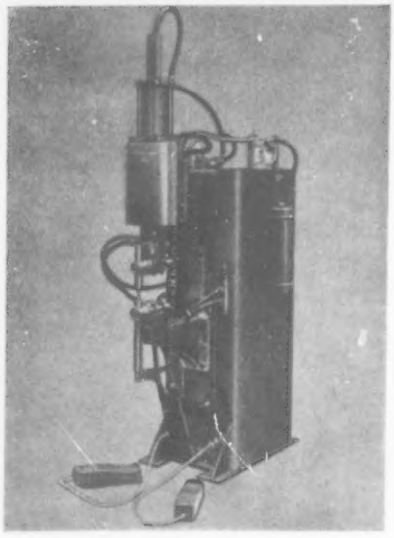
50 KVA Combined chain link annealing machine and bar heater.



10/25 KVA Bench type pedal operated spot welder. Available also with pneumatic control.

British Federal

WELDING AUTOMATION CONTROL



Specialists in complete design and manufacture of all types of standard and special purpose resistance welding equipment from 1 KVA to 1500 KVA or greater, and including fully automatic conveyor and hopper fed lines for high production requirements in the automobile, aircraft, steel, drum and wire industries and all branches of engineering.

- Special Purpose Jigs and Fixtures
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- Electronic Controls
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50/75 KVA Pneumatic spot welding machine with high lift features.

Photographs by British Federal Industrial Film Unit. Established at the Hammersmith, London office of British Federal, the Film Unit is equipped – and available – to undertake industrial cinematography and still photographs for publicity and other purposes, and including full length films equipped with sound track.

For further particulars please contact Head Office.

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TELEPHONE DUDLEY 5470!

IN 6FT AISLES THIS TRUCK CAN LIFT 2500 lb 10 FT!

This truck can reach to a height of 10ft. carrying a maximum load of 2,500lb. in aisles only 6ft. wide. It is made by Lansing Bagnall, the largest and most experienced manufacturers of materials-handling machinery in Europe; machinery that can cut the cost, and time, of any handling operation —in all manufacturing, distributive and extractive industries.

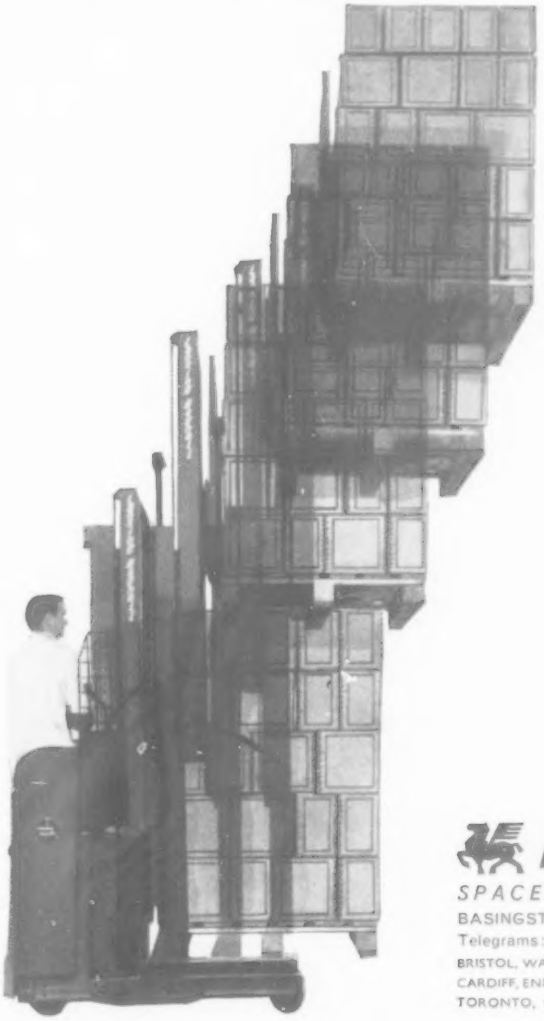
Brilliant Features Lansing Bagnall's FRES 2 reach truck, with its extension/retraction design, allows it to stack at right-angles in aisles only 6ft. wide. With the masts retracted the load is carried between the wheelbase—giving excellent stability, and safety for the load and operator.

Low Operating Cost The FRES 2 works a full shift on one battery recharge at a cost of 1/6d. Batteries are recharged simply by plugging into the nearest power point of standard AC mains supply. For continuous shift-working, batteries can be changed over by one man in a few minutes.

Simple Operation All controls are within finger-tip reach. One-hand steering leaves the other hand free for control of speed or lifting, lowering and reaching operations, and permits rapid manœuvring with maximum comfort and safety for the operator at all times.

Instant Accessibility The drive and charge units are completely exposed for maintenance by opening a heavy-plate rear door. The battery is also readily accessible for inspection, and topping-up can be completed in a few seconds.

After-Sales Service Lansing Bagnall offer the most efficient and comprehensive after-sales service in the industry — 14 regional depots throughout the country with over 40 service vans on call 24 hours every day throughout the whole life of every truck.



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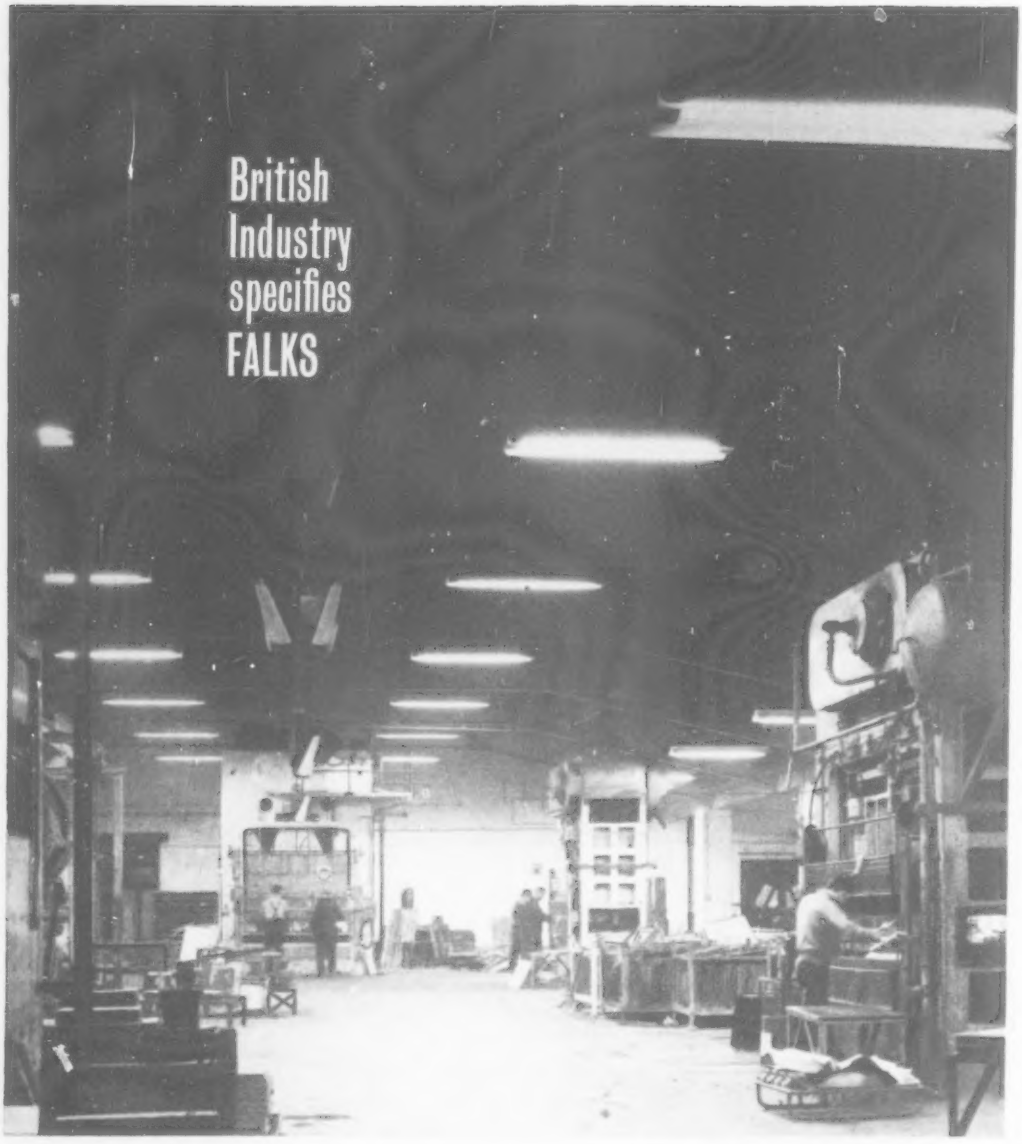

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plastic bonded to steel sheet

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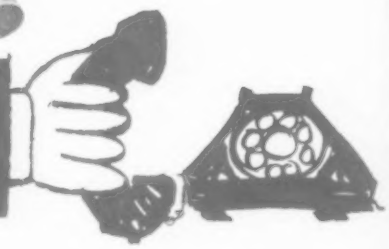
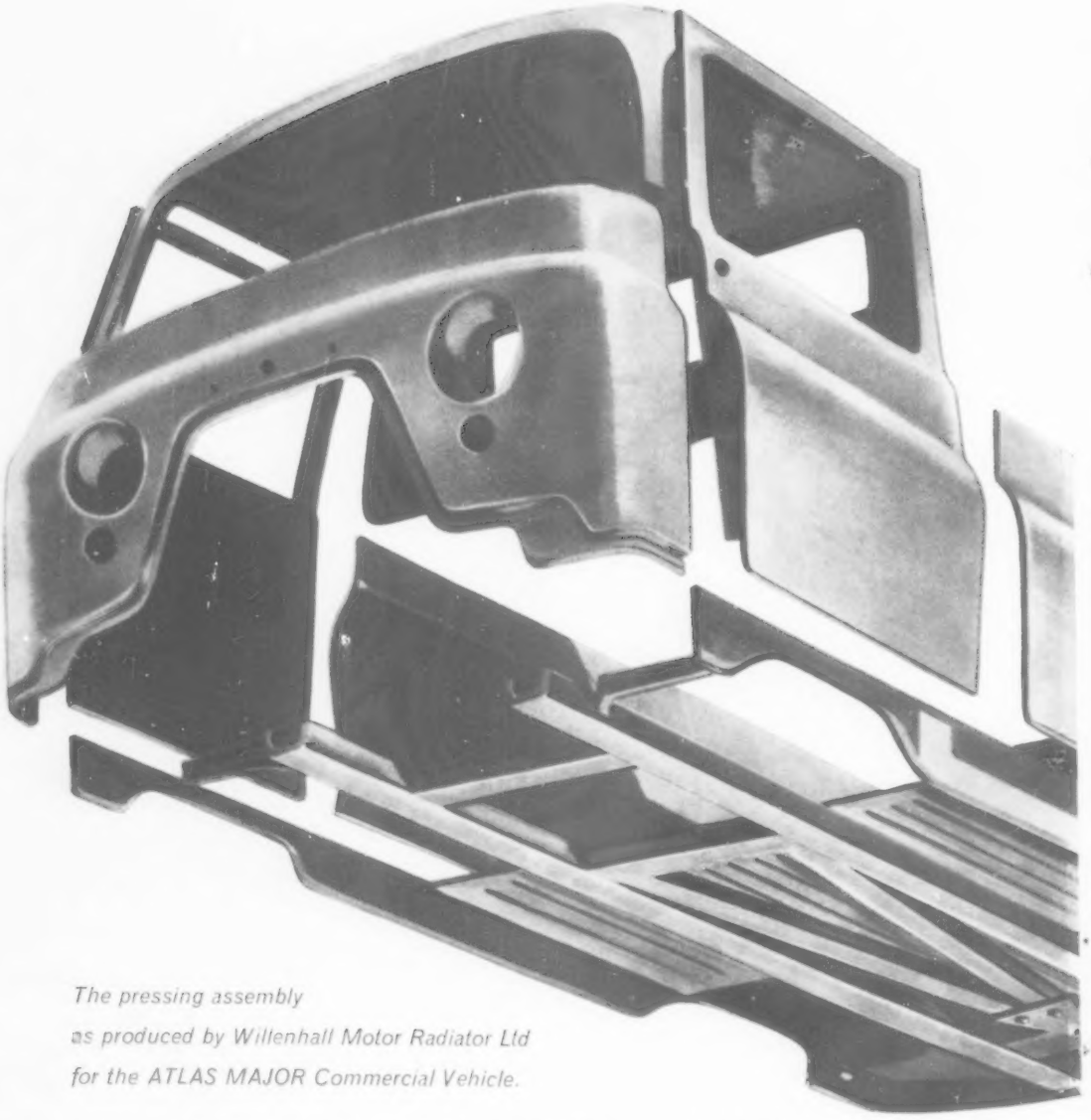


STEEL STOCKHOLDER SERVICE

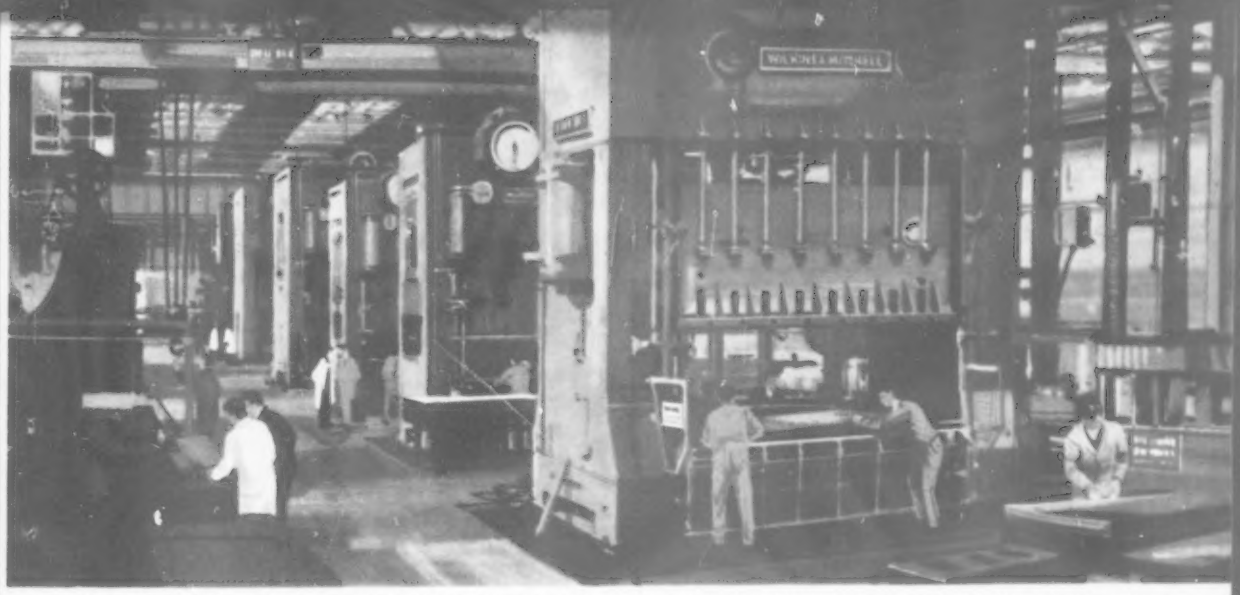
GRADES METALS LIMITED HANWORTH LANE, CHERTSEY, SURREY Telegrams Gradesmet Chertsey

PRESSING FOR PRODUCTION



The pressing assembly
as produced by Willenhall Motor Radiator Ltd
for the ATLAS MAJOR Commercial Vehicle.

WILKINS & MITCHELL LTD · DARLASTON · S. STAFFS · ENGLAND

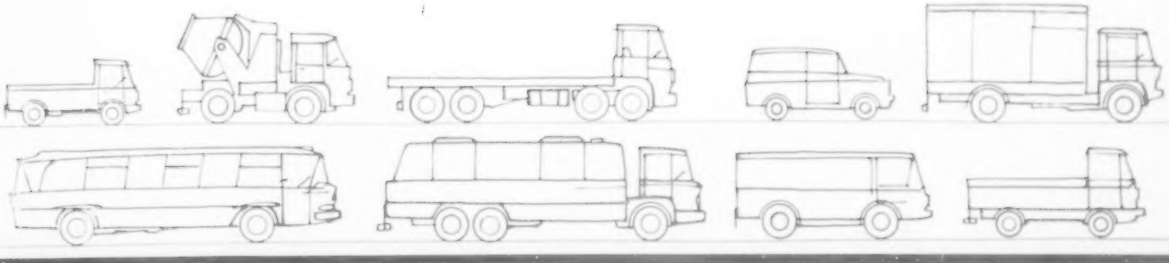


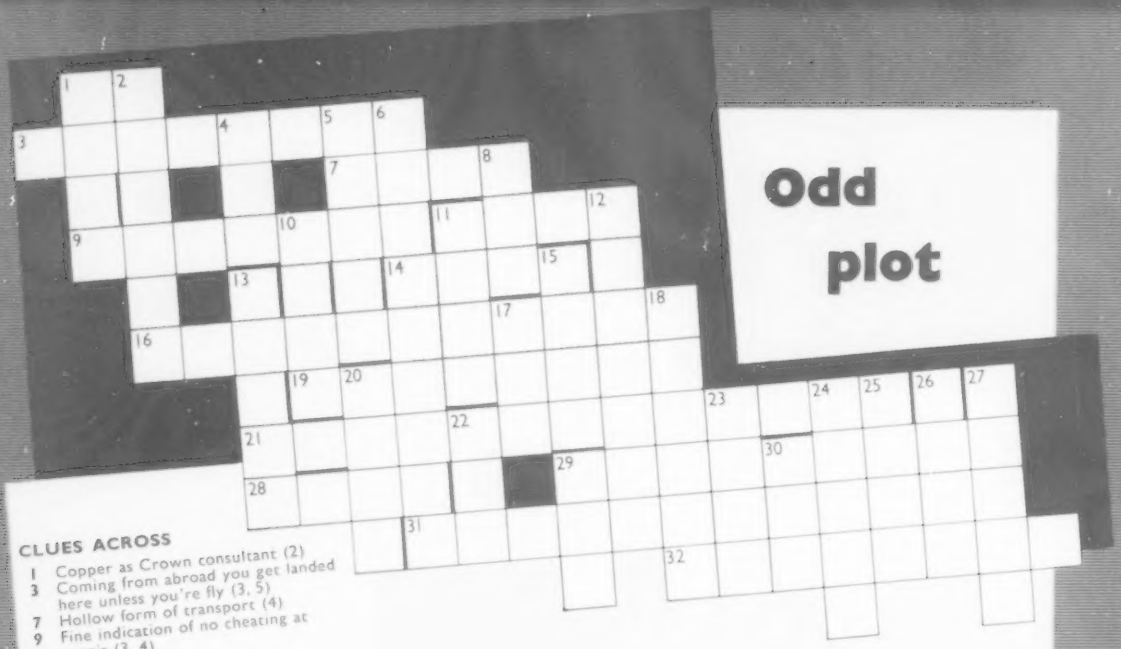
WILKINS & MITCHELL PRESSES (350, 400, 600, 800 tons capacity) at Willenhall Motor Radiator producing the pressings shown.

The preference of so many of the busiest press users for Wilkins & Mitchell Presses, especially in their most recent installations, is based on their need for higher productivity. Experienced users have learned to rely on the design, dependability and built-in reserves of Wilkins & Mitchell Presses which contribute so materially to better margins in this competitive field. Why not consult us on *your* press requirements.

WILKINS & MITCHELL

The Presses that cut costs





Odd plot

CLUES ACROSS

1 Copper as Crown consultant (2)
3 Coming from abroad you get landed here unless you're fly (3, 5)
7 Hollow form of transport (4)
9 Fine indication of no cheating at tennis (3, 4)
11 A short cut (4)
14 Lone lad at Christmas (4)
16 Cattle rustling? (11)
19 Beside this, loved hands were pale (8)
21 Combination of clapper and beater in the garden (4, 5, 4)
28 The goldsmith's mark (4)
29 Cowboy guide at sea? (9)
31 No use going shopping this afternoon (5, 7)
32 Is his father the kirk official? (5, 3)

CLUES DOWN

1 Criterion of likeness (4)
2 Cut by a frisky cook? (6)
4 Taken regularly in coffee (3)
5 Does the 30 gum up? (5)
6 Will reverse the engine to give one the advantage (9)
8 A trifle meretricious (3)
10 They have to be cut out on the curve (4)
11 "And his heart was hot within him, Like a living . . . his heart was" (Hiawatha) (4)
12 Net play lands you with this (7)
13 Provides entrance coverage (5)
15 Though lame, the young devil got half a century (4)
17 Hide me in Scottish order (3)
18 "The glory that was . . ., the grandeur that was Rome" (Poe) (6)
20 Two understanding one (4)
22 Can she be found in the New World? (3)
23 William Archer (4)
24 Makes sense in Germany (5)
25 Ruler turns up with a frosty look (4)
26 Do they keep their idols cool? (4)
27 Concealed by the old woman's redingote (5)
29 Christopher was a tinker (3)
30 16 ft. 6 in. cane (3)

If this were a bit of ground, the architect would be calling on a hundred trades (though we don't know that he'd bother with the implied buttresses).

But in the everyday production of everyday articles, modern materials are used in rich variety—plastics, die-castings, parts from automatic lathes and other more complex machines.

AND pressings from steel strip. Ranging from blanked out flat parts (maybe a bit fancy in shape) to deep-drawn parts of solid-looking rotundity, simple flanged and bent parts, subtle little parts with coined-up projections . . . as you know, all these indispensable important components come from steel strip—probably ours.

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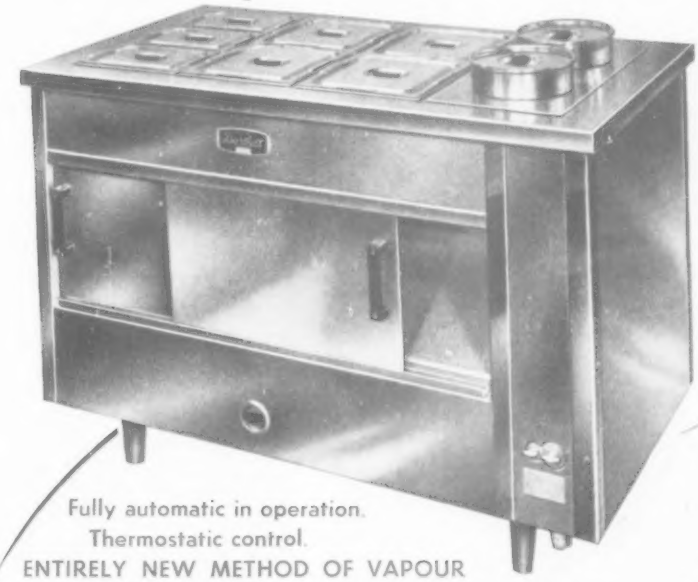
known by many as—

'Lancs & Corby'

THE 'Mayland' HOT CUPBOARD



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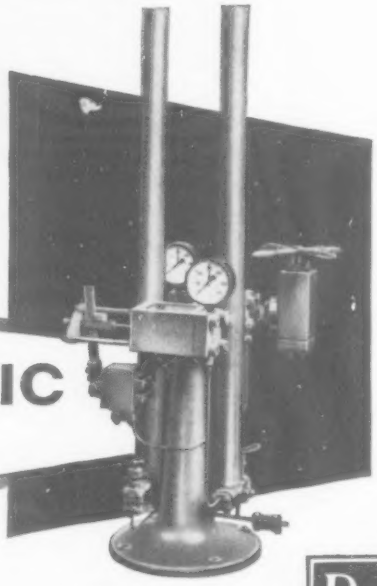

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Quick delivery of large or small quantities, cut to size if required, is a feature of that service.

The combined services of the stockholders and ourselves offer you . . .

the **Steel** you need . . .

in the **Form** you need . . .

When you need it

We have a large number of stockholders covering the United Kingdom as an integral part of our distribution system. You can confidently entrust them with your business and we will be pleased to send you a list of them.

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Croda

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Rust preventives:
Most of the Croda range are based on lanolin called the finest organic metal protective compound by the National Physical Laboratory. As manufacturers of lanolin, Croda can offer rust preventives at highly competitive prices.

Metacon rust remover:
not only removes all rust from ferrous metals but also in the same operation gives the metal a rust preventive coating.

Strippable coatings: Crocell:
hot dip thermoplastic coating protects metal parts from corrosion and mechanical damage.

Rhinohide:
tough plastic applied by spraying, protects large parts.

Dewatering rust preventives:
lanolin based dewatering oils remove all moisture from metal and leave an oily preventive film on the surface.

Magisol:
special solvent blend removes grease and oil from metal surfaces.

Croda Ltd., Cowick Hall, Snaith, Goole, Yorks; and London, Manchester, Edinburgh, Dusseldorf, Milan, New York

Steel Sheets from Stock

IS SPACE YOUR PROBLEM?

Quite apart from loss through age hardening and other forms of deterioration, many firms simply haven't the space to carry the amount of steel they use. From their comprehensive stocks RALPHS can give immediate delivery of Sheets as required. Thereby you not only save space but conserve your capital for other purposes.

If you are interested we shall be only too pleased to send you one of our Weight Calculators - free, of course.

Sheets cut to customer's requirements.

HOT ROLLED PLATES · HOT ROLLED SHEETS · COLD REDUCED SHEETS · GALVANIZED SHEETS · ZINC-COATED SHEETS

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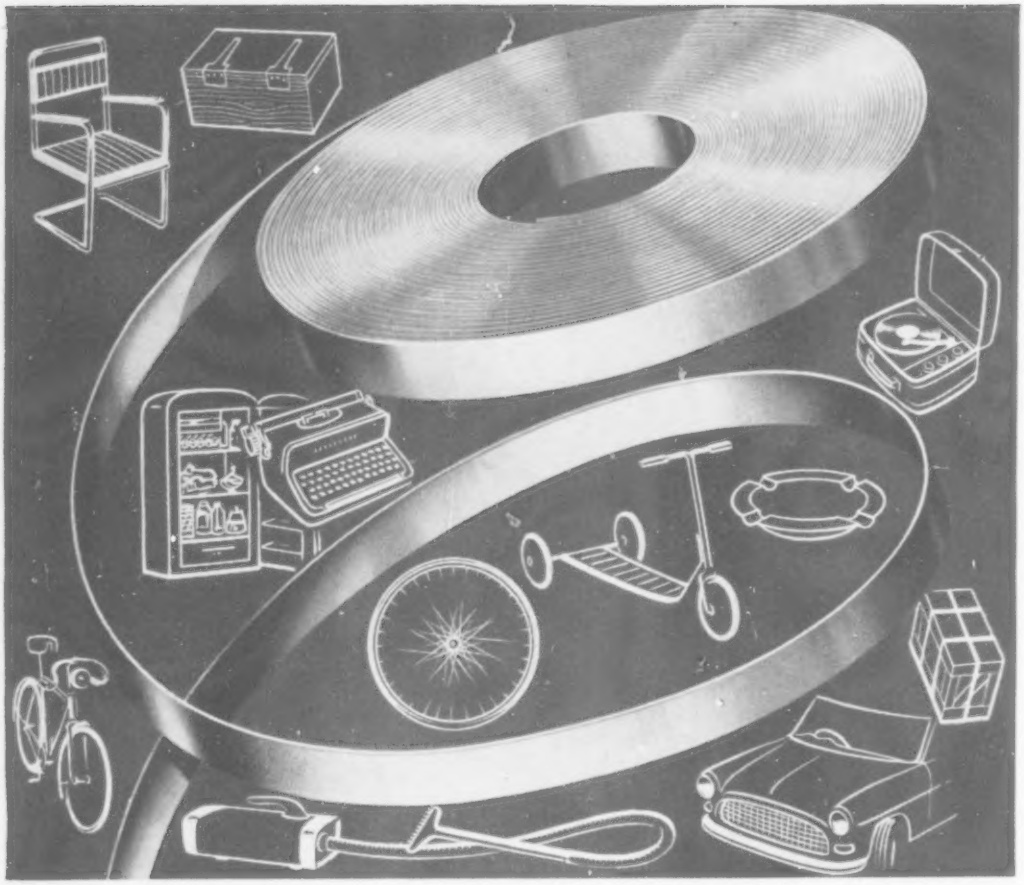

COLD ROLLED STEEL STRIP

in coils and straight lengths

All widths ¼″ to under ½″ X 0·008″ to 0·064″
½″ to 15″ incl. X 0·008″ to 0·128″
over 15″ to 20″ incl. X 0·008″ to 0·080″

Tempers and Finishes:—
Unannealed: Fully Hard, ¾-Hard and Medium Hard. Bright only.
Bright or Blue Annealed: Ordinary Soft, Dead Soft and Deep Drawing qualities.
Annealed and Re-rolled: To intermediate tempers as specified.
Electro Galvanised Strip: 6″ to 18″ X ·008 to ·036″. Widths narrower than 6″ can only be supplied with edges sheared after galvanising.

ALSO TUBE STRIP; HIGH TENSILE STRAPPING, PACKING CASE HOOPS, AND CABLE TAPE, IN BRIGHT OR BLUED FINISH.

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Cruickshank-Pennsalt Drawcote in use at Hoover

Pennsalt Drawcote dry film lubrication is the key to successful deep drawing of the tubs for the famous Hoover Keymatic washing machine.

Pennsalt Drawcote has an extremely high lubricity value with a high film strength under extreme pressure. At the same time it produces an efficient separating barrier between blank and tools to permit severe draws with an absence of score marks or ruptures. This process also prolongs tool life.

Blank Specifications

1	Size of Blank	28½" diameter
2	Gauge of Metal	.036"
3	Material Spec.	Extra deep dwg. quality
4	Wall Reduction	No appreciable reduction
5	Speed of Press	1" per second

Press Details

Blank Holding Pressure 110 tons
Arm Pressure 80 tons
Cushion Pressure 25 tons

Cruickshank's Pennsalt plant installation at Hoover's Merthyr Tydfil works

For further information, please write to Desk No. 0.3

CRUICKSHANK'S
A DIVISION OF FORESTAL INDUSTRIES (U.K.) LTD.
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**Pennsalt is a Trade Mark of the Pennsalt Chemicals Corporation, Philadelphia, Pennsylvania, U.S.A., licensed to Cruickshank's, for use in the U.K.*

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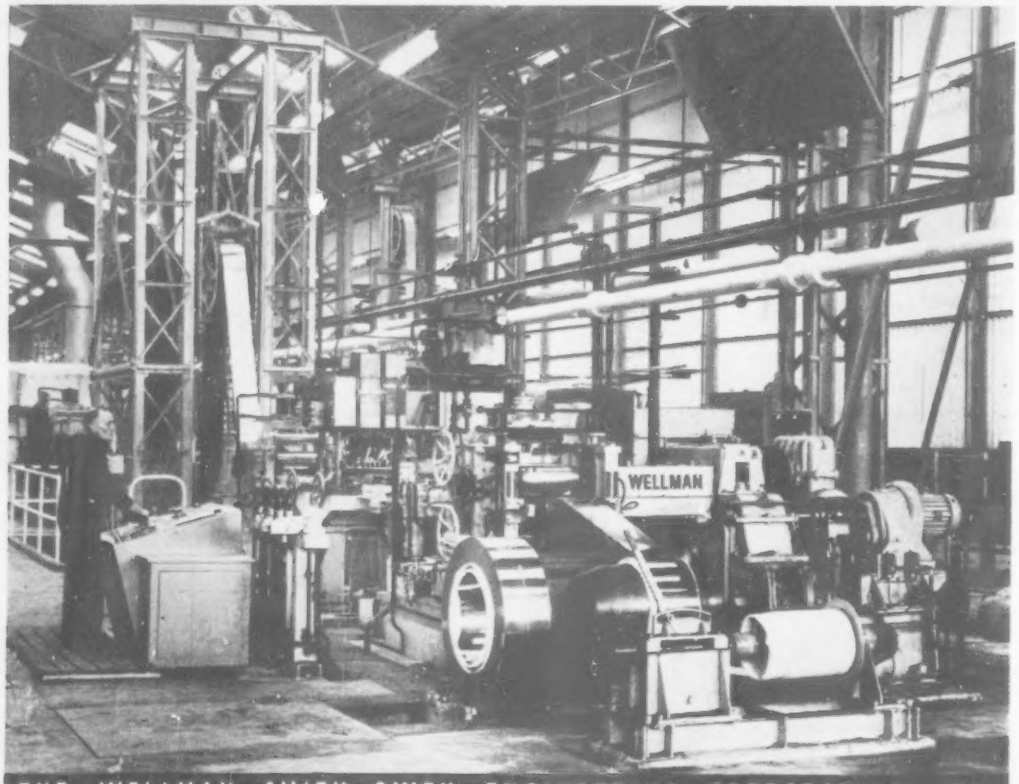
Auxiliary
Rolling Mill Equipment

Illustrated below is the entry end of the 12" Cold Rolled Stainless Steel Softening and Descaling Line installed at the Shepcote Lane Works of Firth-Vickers Stainless Steels Ltd.

This is an interesting example of a Line designed and constructed for the final processing stages of narrow stainless steel strip, some of which is produced as wide hot rolled coils, and softened and descaled on three Wellman Lines prior to slitting into suitable widths.

We have supplied several such installations, in this country and abroad, together with the necessary auxiliary lines for Coil Build-up, Recoiling, Slitting and Shearing to length and suitable for all grades of Stainless Steels.



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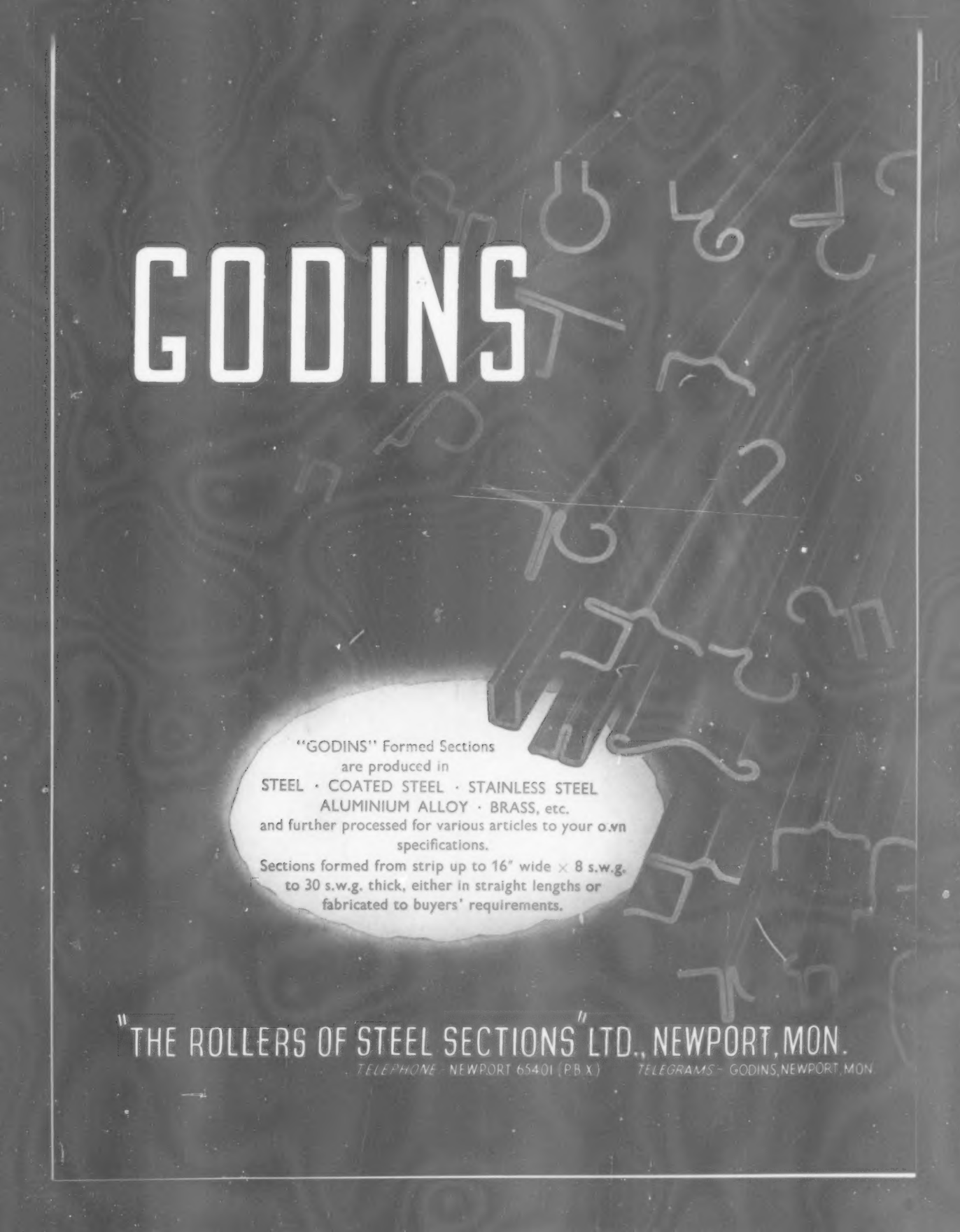
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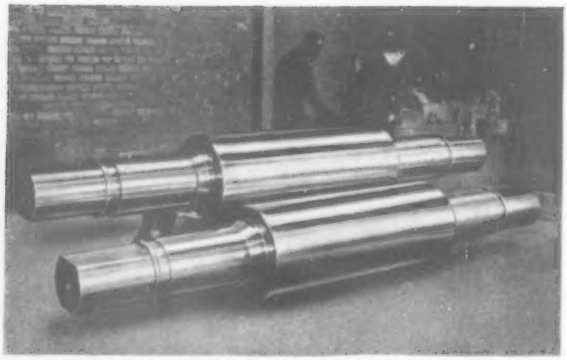
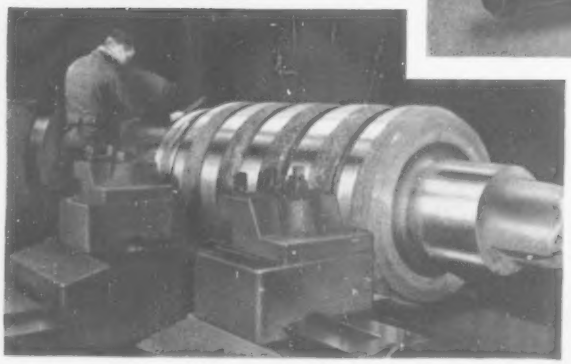
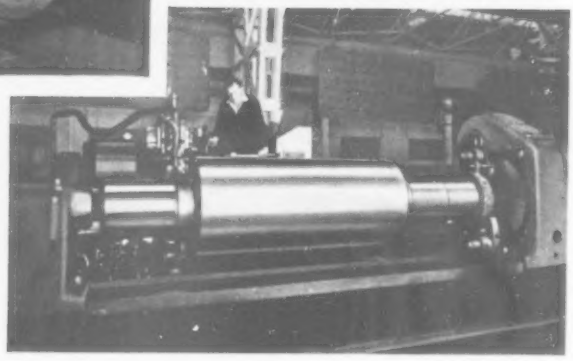




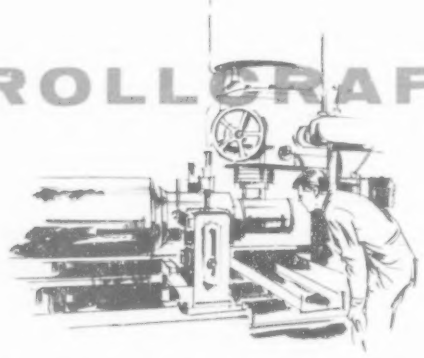
Finishing Roll for a Heavy Structural Mill.

Grinding a Chilled Hollow Roll for a Rubber Callender.



BRIGHTSIDE

ROLLCRAFT



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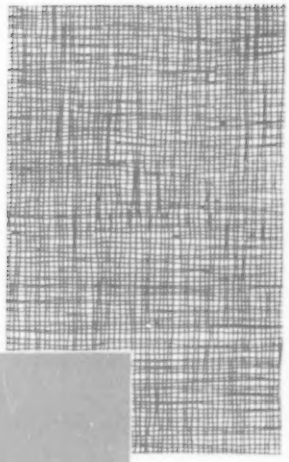

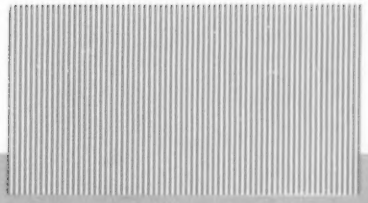

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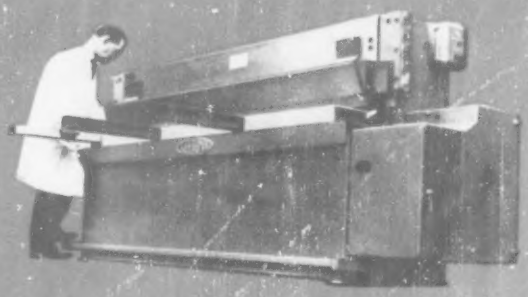
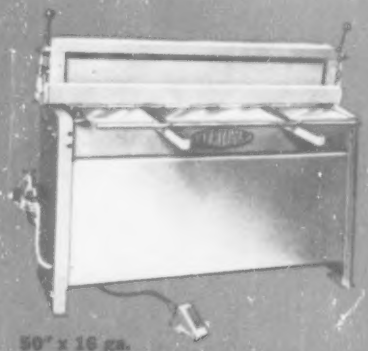
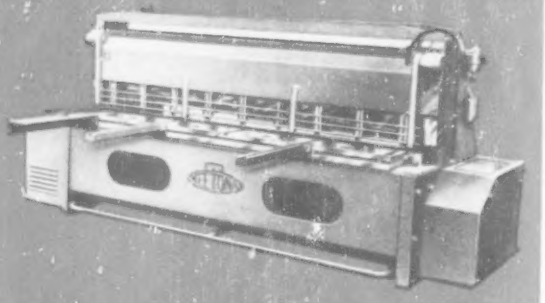


70" x 10 ga. SHEAR



50" x 16 ga.
AIR OPERATED SHEAR



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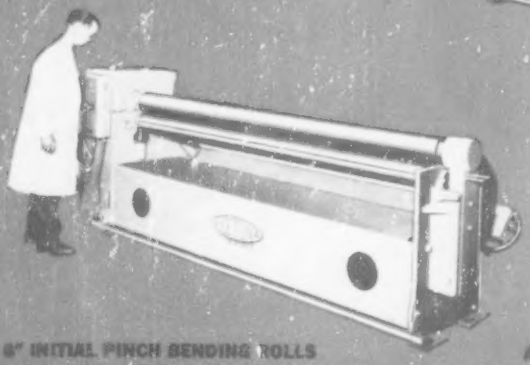

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Max. traverse of Spindle	22½"	28"	36"	44½"
Max. distance Spindle to table	28"	36"	44½"	55"
Max. dia. faced	25"	32"	48"	55"
Working surface of revolving table	36" × 28"	44½" × 36"	50" × 44½"	64" × 56"
Max. distance between Facing Head and Outer Support	5' 11"	7' 5"	9' 4"	11' 10"
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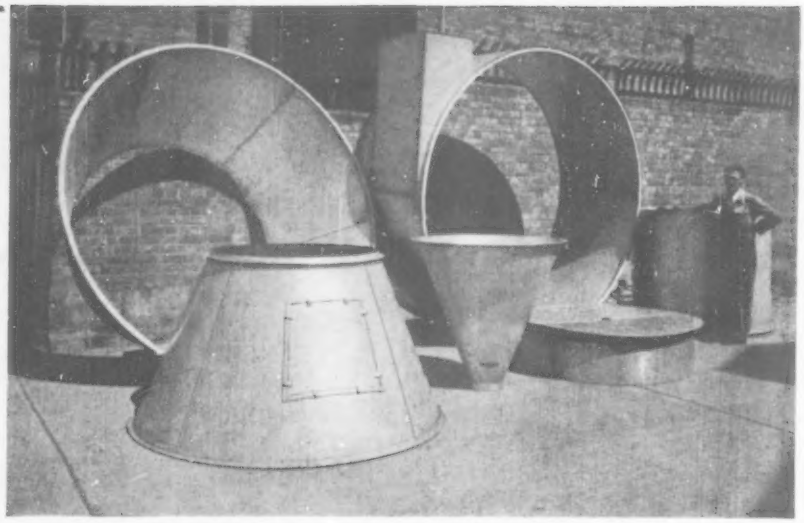

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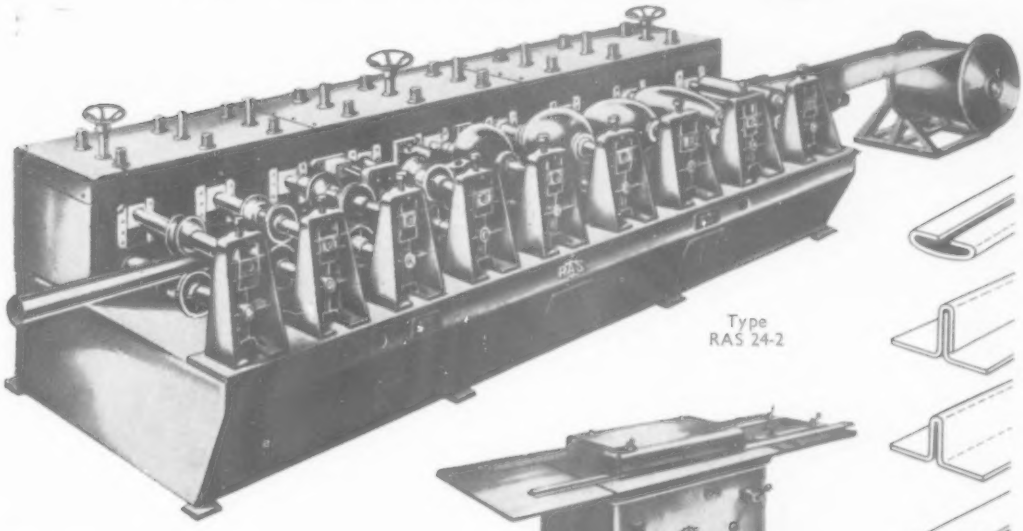
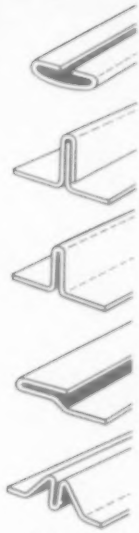


Type
RAS 24-2

Type
RAS 22-1



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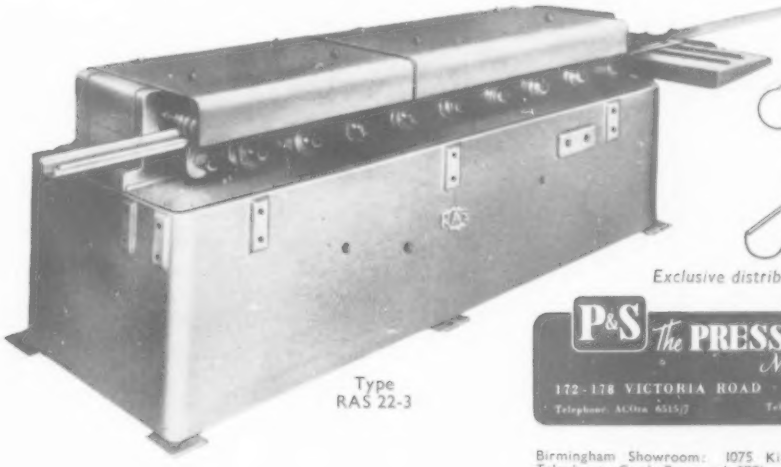

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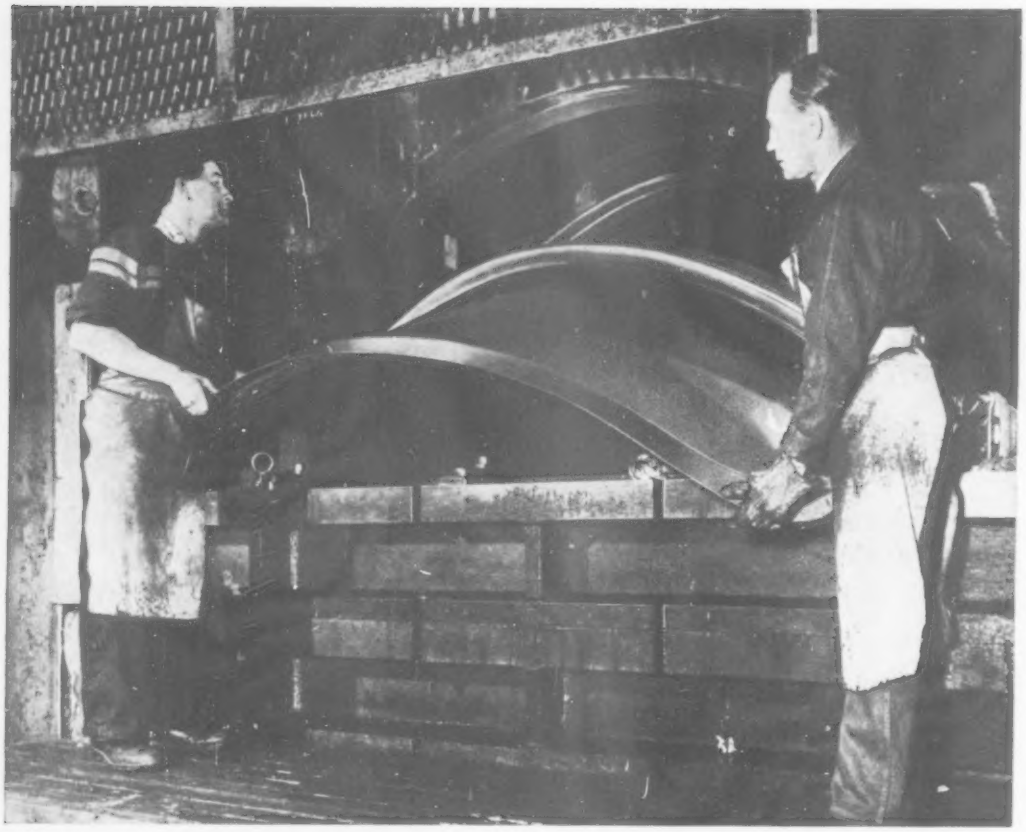

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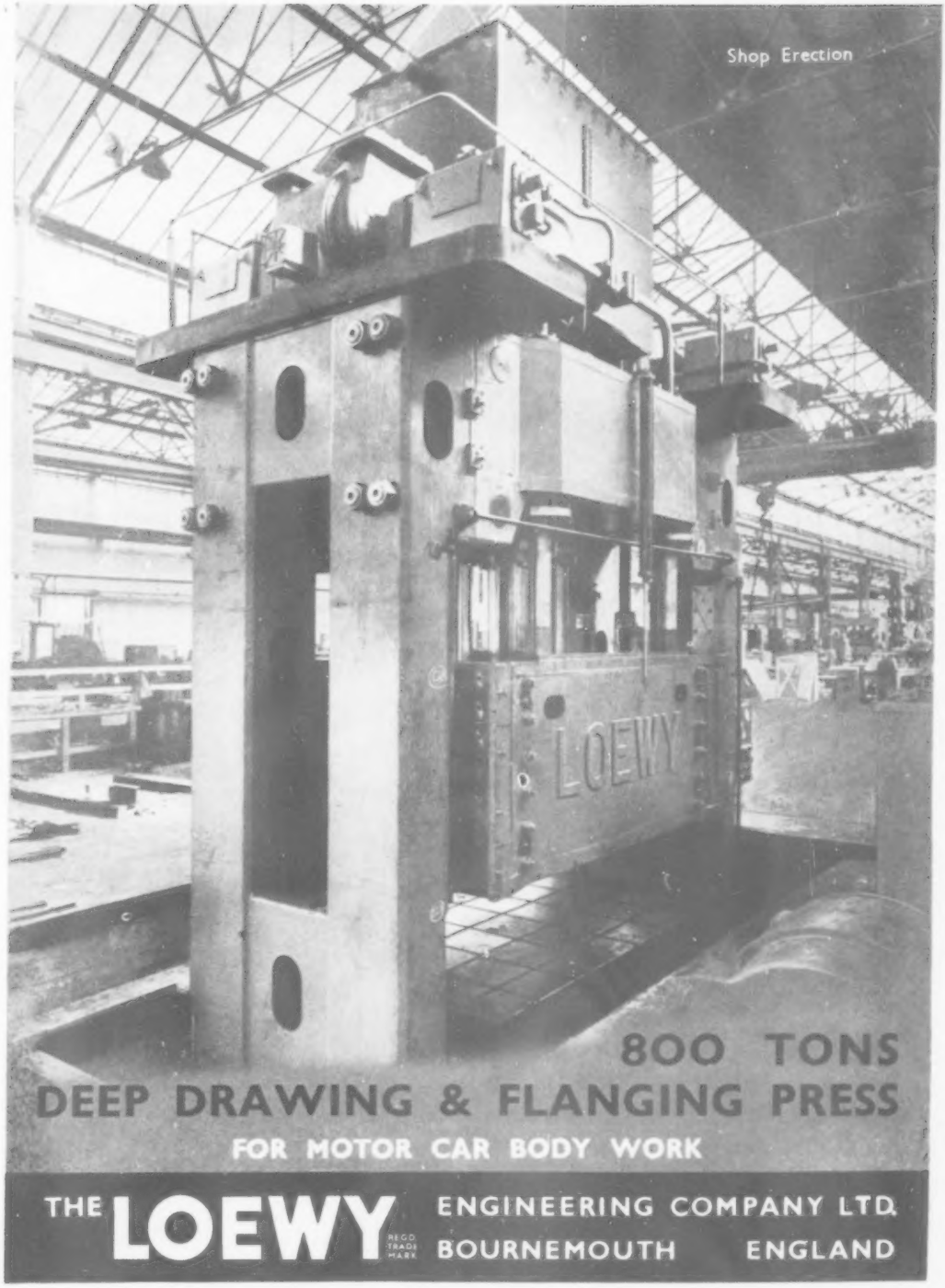
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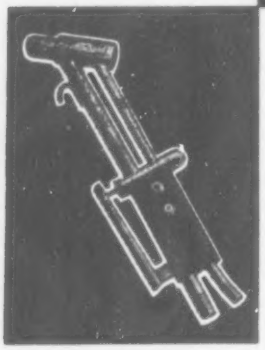

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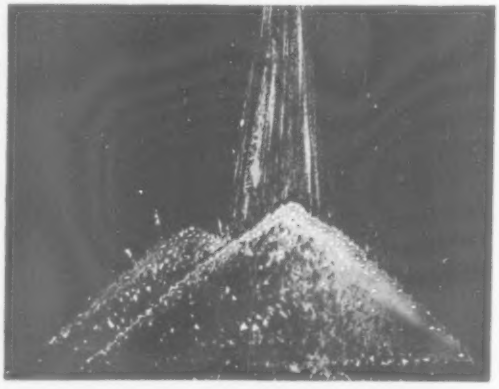

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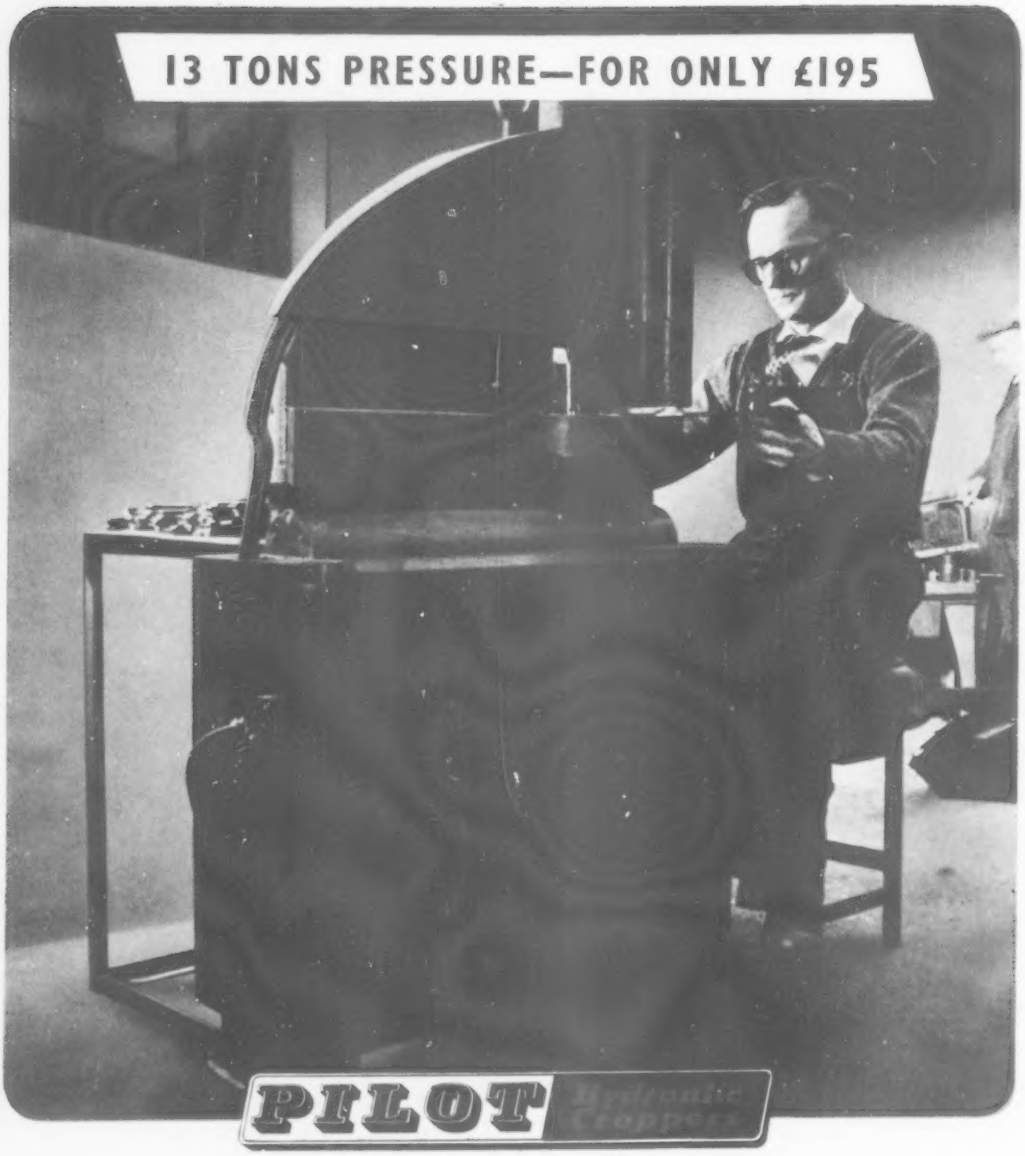

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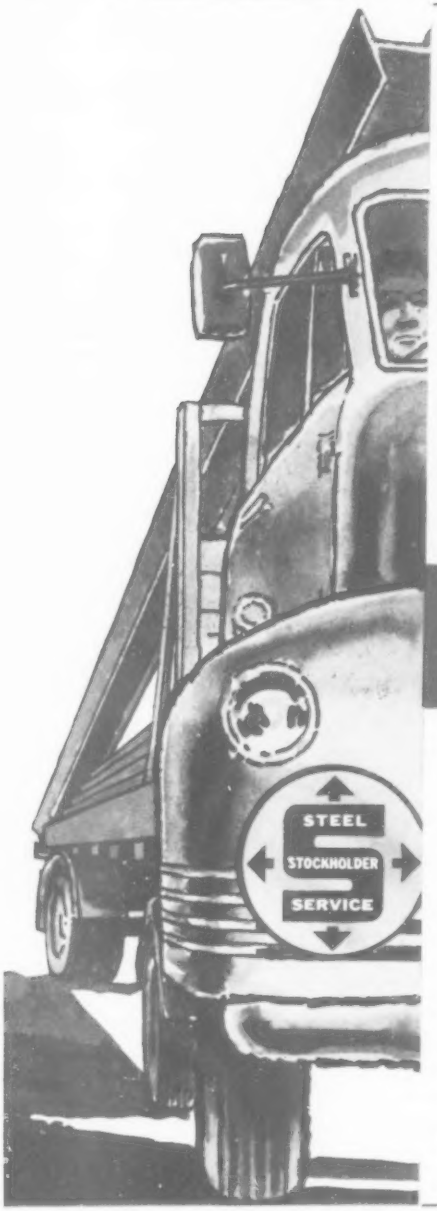

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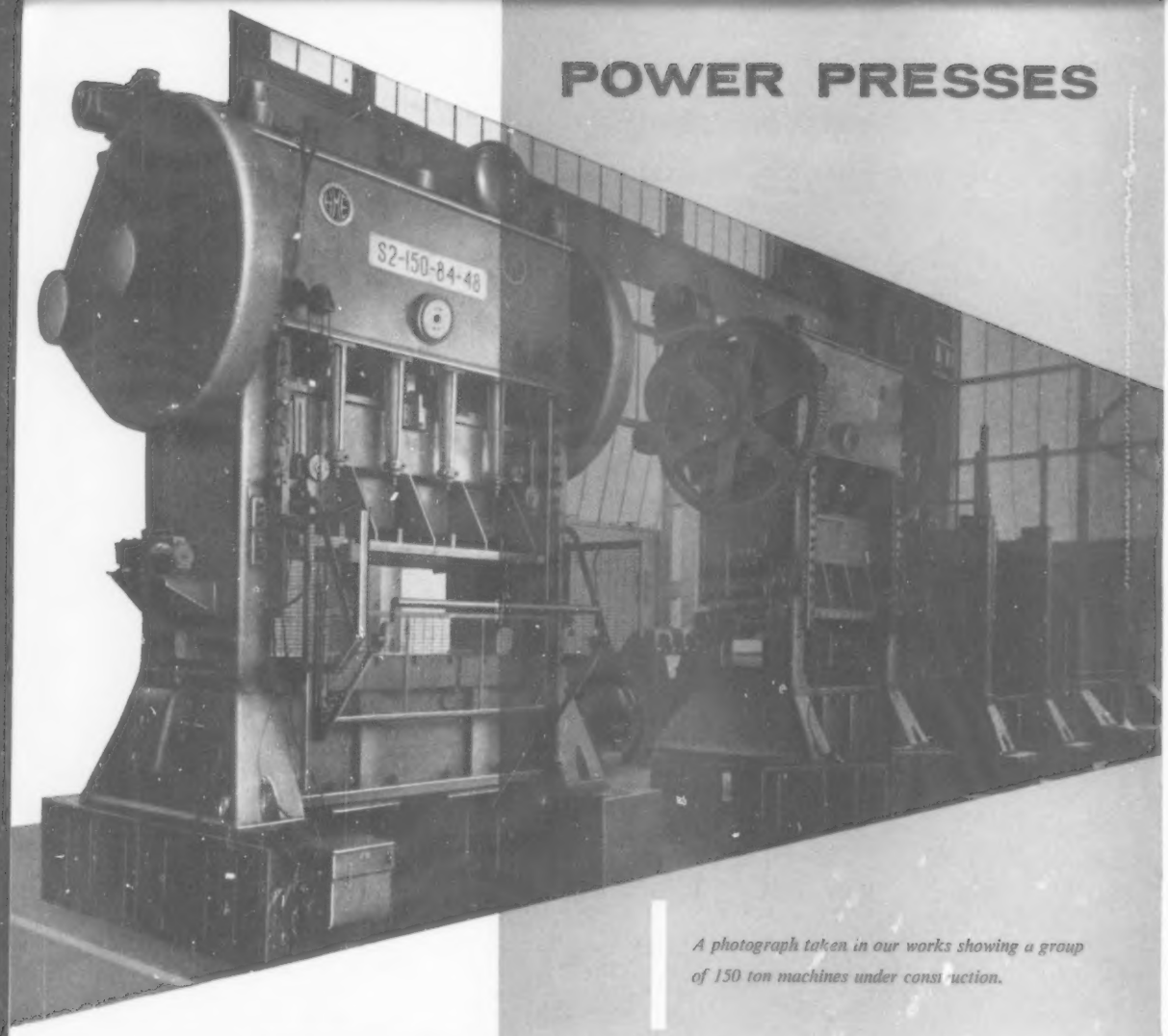

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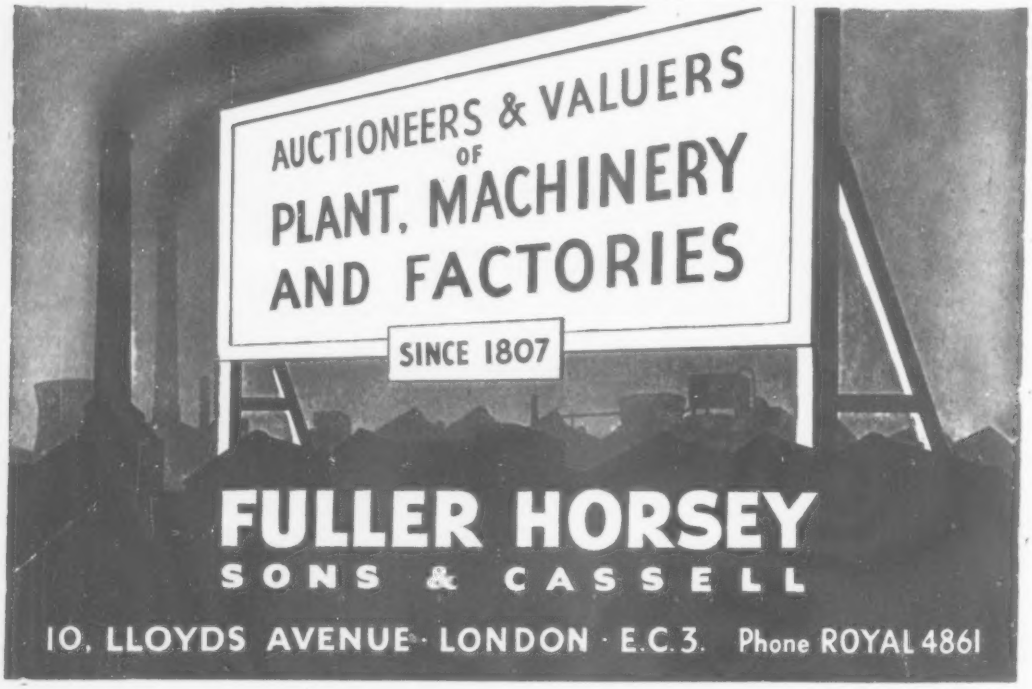

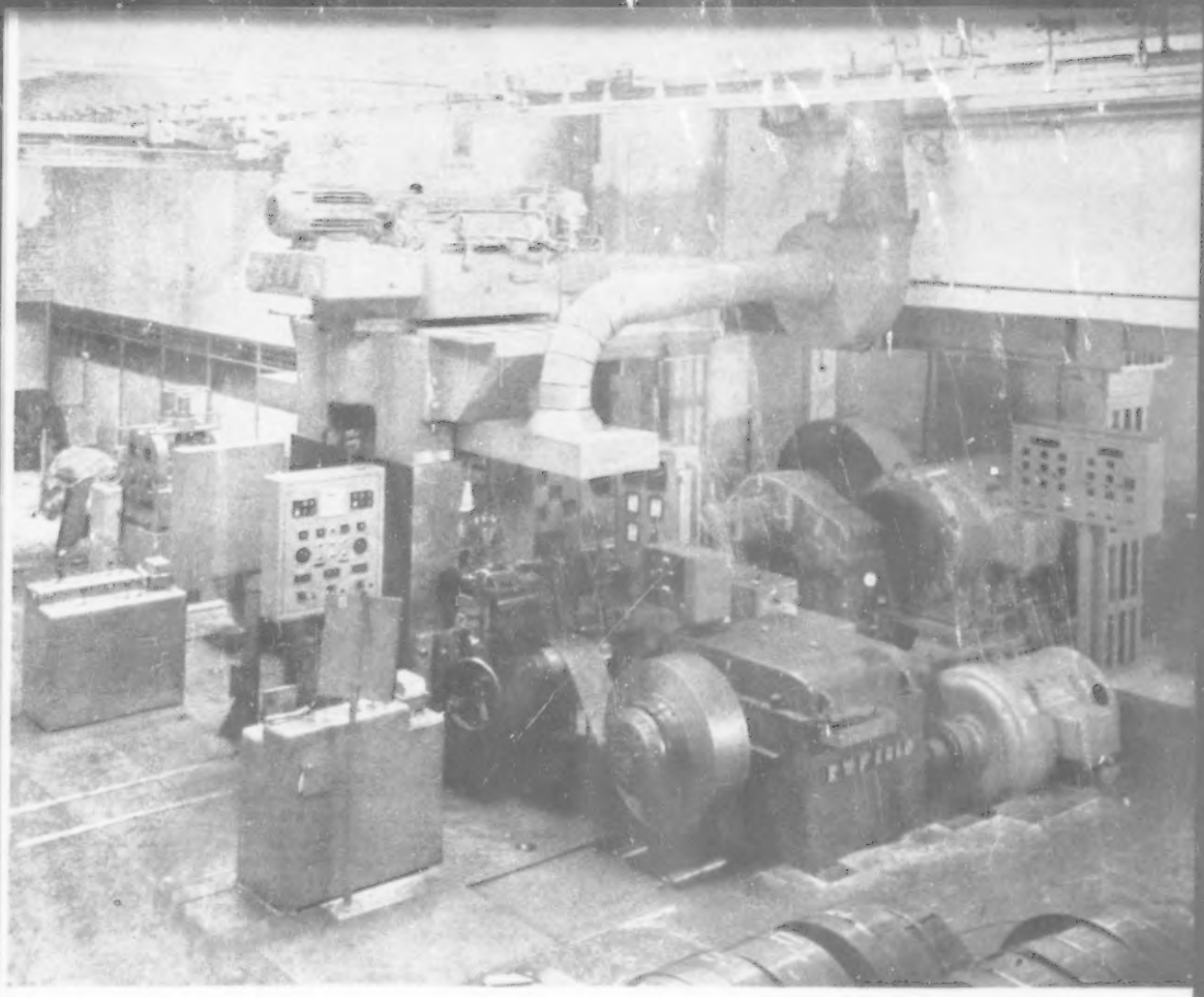

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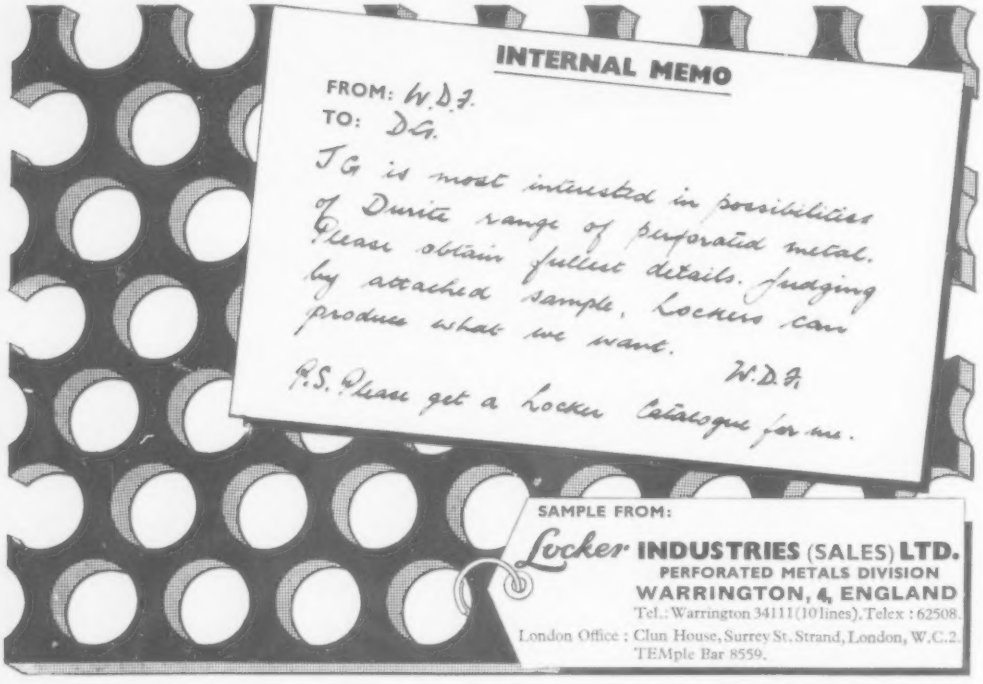
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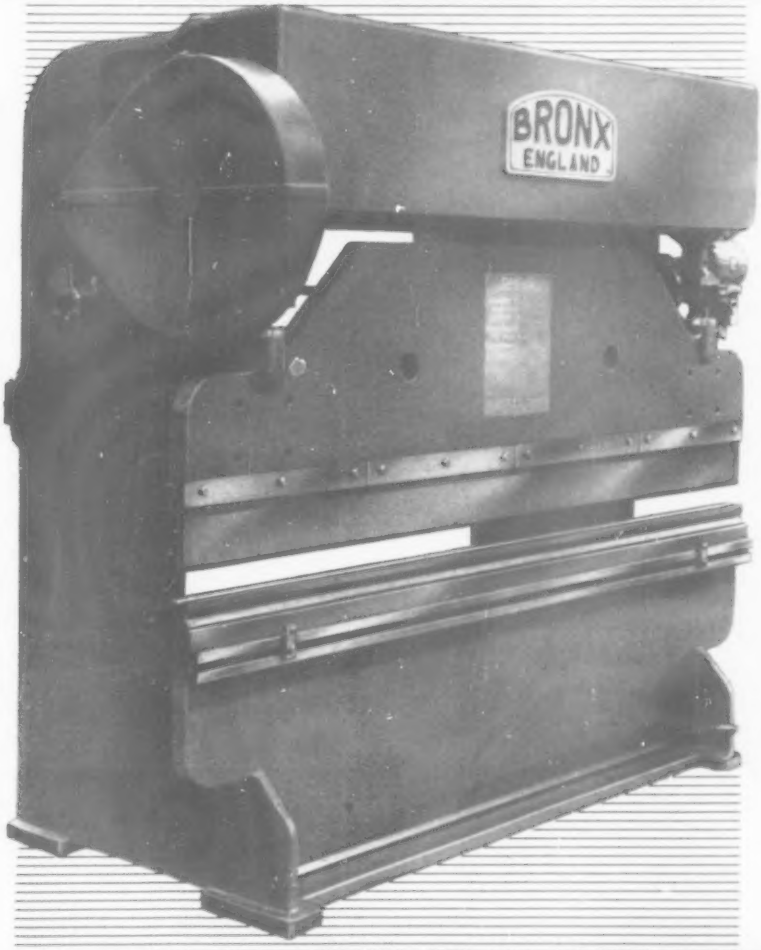

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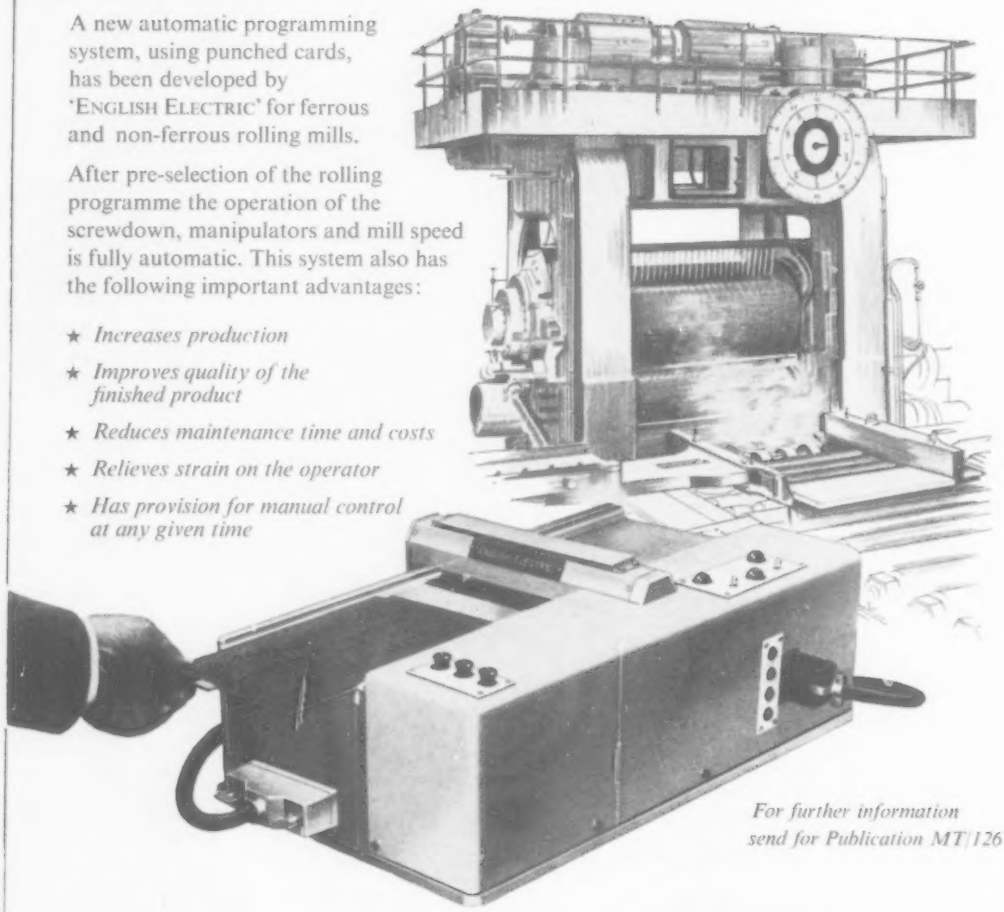

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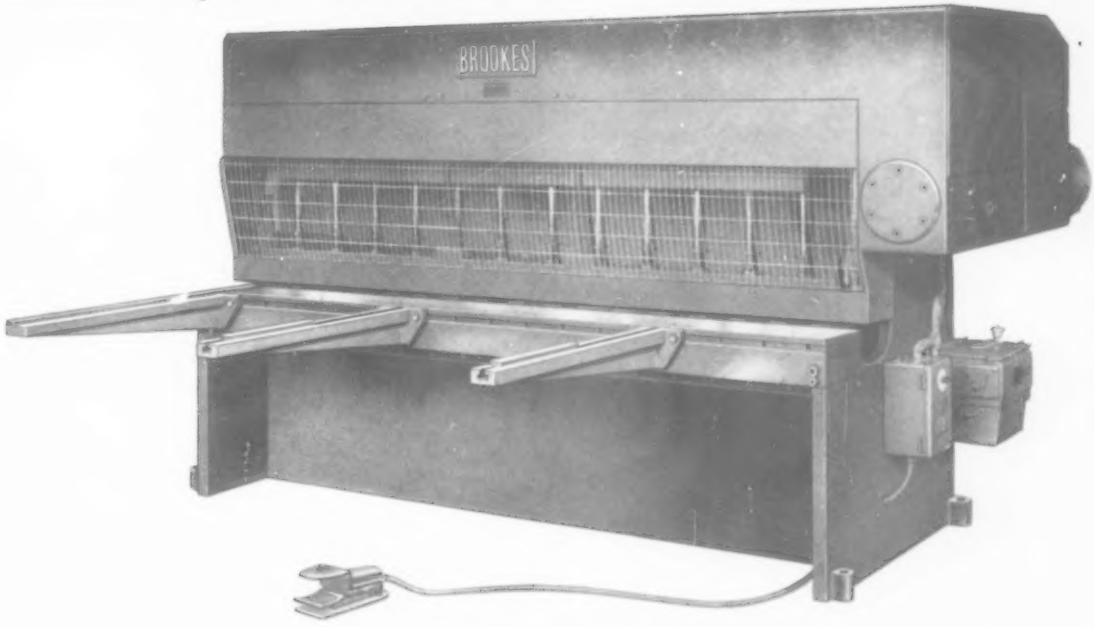

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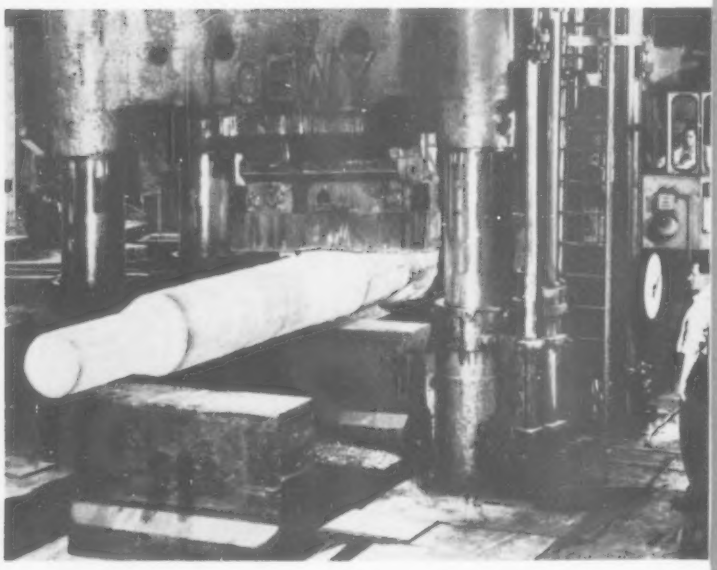

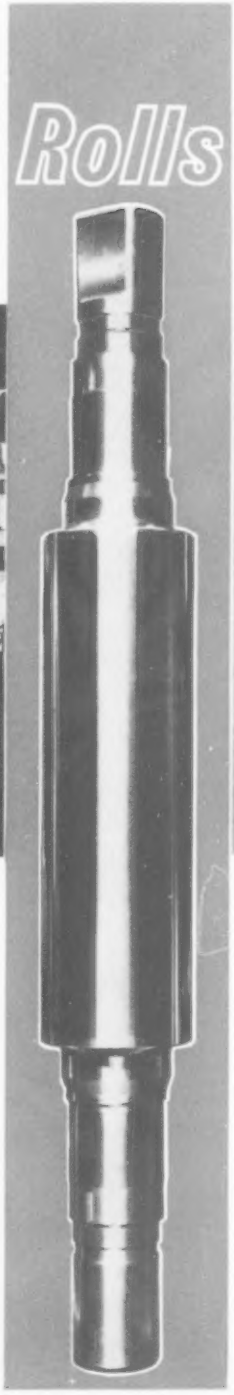

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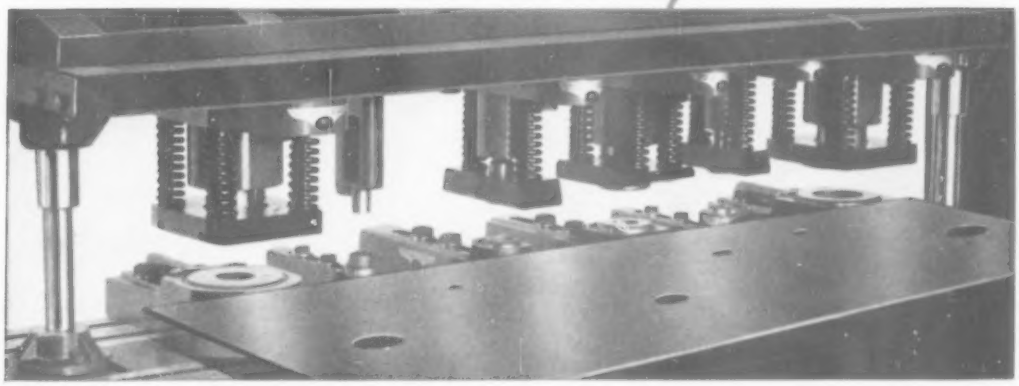

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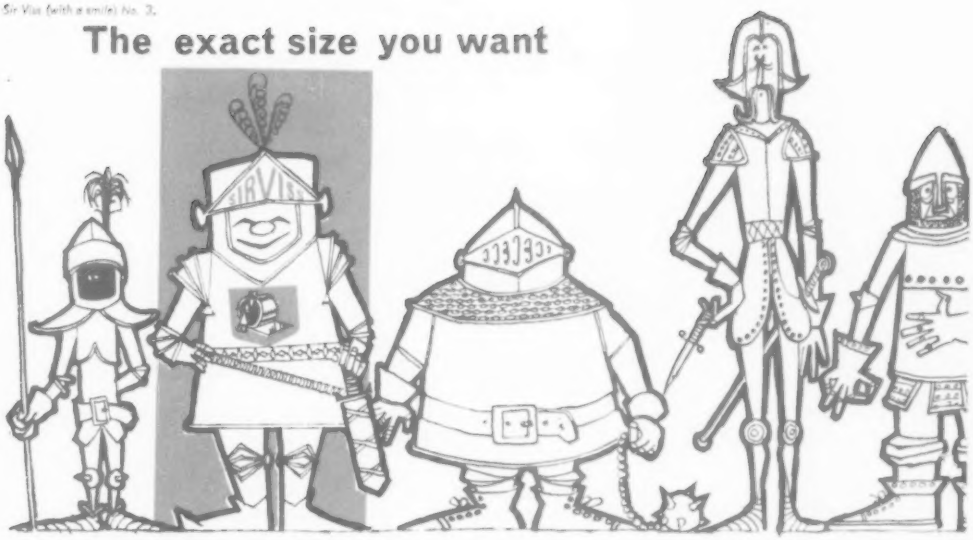

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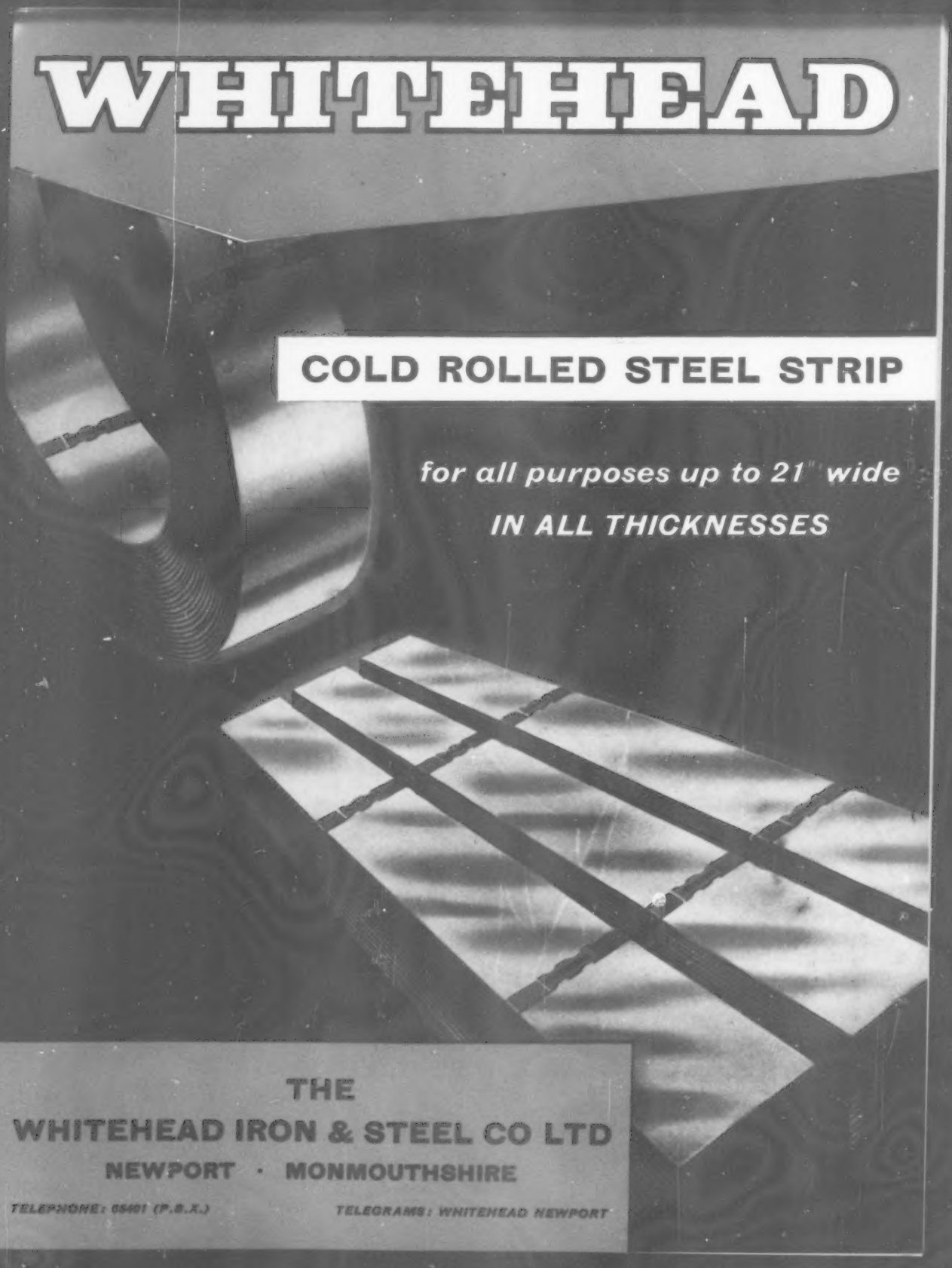

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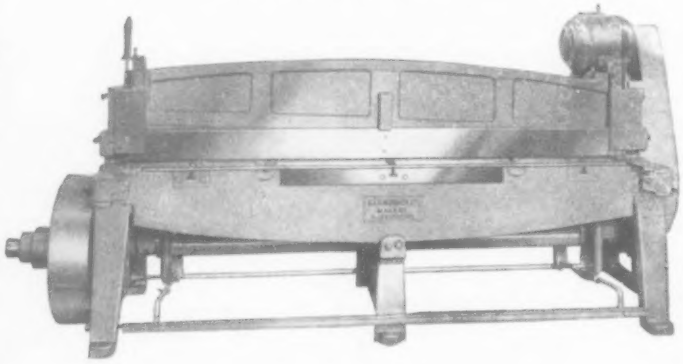

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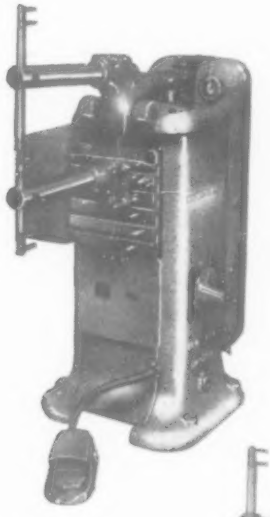

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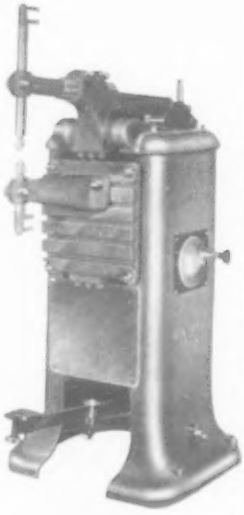

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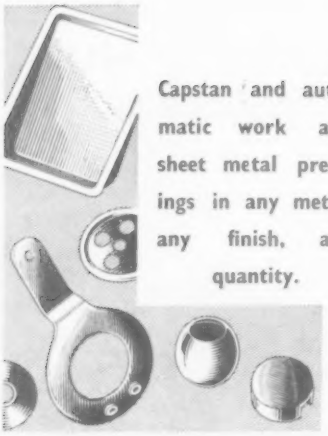

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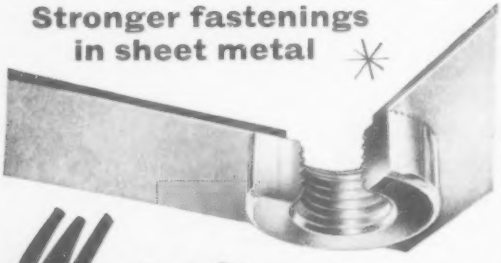

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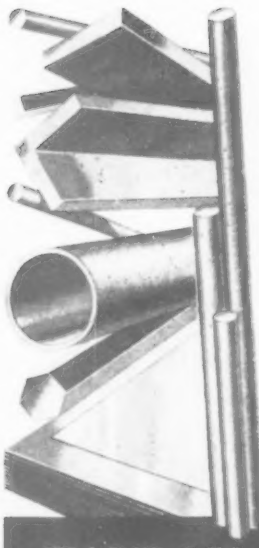

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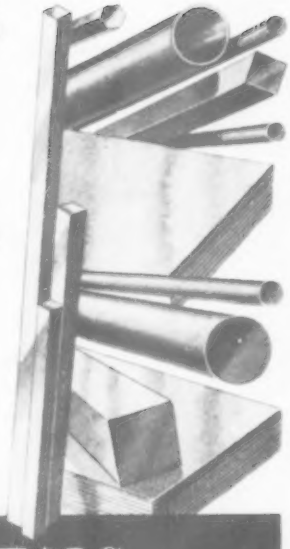

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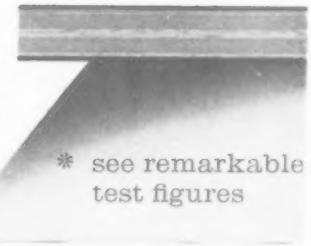

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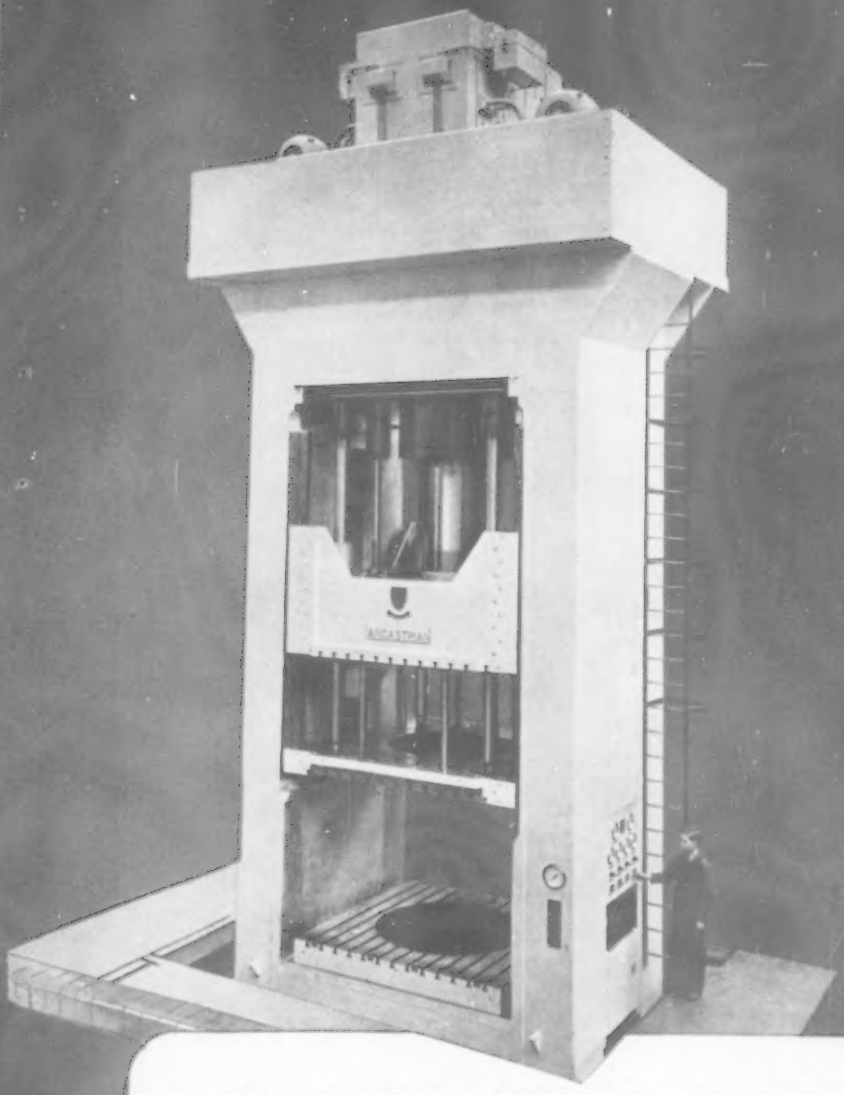

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A title worn for ninety-five years is not lightly to be cast aside, and, in this climate of change, let us first look at what is unchanged, steadfast, immutable. Such is our proven loyalty to coal and those who win it; COAL has spelt out its worth and its achievements on our cover—as through all our pages—for a near-century, and we are justly proud of our intimacy with a brave and virile industry. Whatever else may change, we speak for coal.

COAL remains COAL, then, but IRON becomes STEEL. When this journal was born, Bessemer's great discovery was but ten years past, and no thought then arose of nailing steel's colours to our masthead. But from now on let there be no doubt; STEEL & COAL believes in steel, will blazon to the world the benefits of steel. It will be the journal for the *user* as well as the *maker* of steel; new methods of manipulating it, new products incorporating it, new processes employing it—all will be fully and expertly treated.

In tune with these shifts of stress we plan many a change in presentation. A larger page has been long requested and recommended by those who purchase advertising space and those who design material to fill it; we are glad to be able to fulfil our own plans and their wishes simultaneously. In the interests of the busy executive we are radically restyling the layout and type of the journal; numerous innovations will be aimed at making features more rapidly located, data more easily assimilated, indexing more complete. The standard of presentation of STEEL & COAL will be as high as that of any specialist journal in the world.

And so we step out towards our century, and, doubtless, our second century. Mind cannot conceive of a time when the technique and practice of coal winning and utilization, of iron and steel manufacture and manipulation, will be able to dispense with their own specialist literature. Always will there be experience to be shared, information to be disseminated, data to be evaluated. STEEL & COAL will proudly bear these responsibilities, for its blueprint for progress is firmly founded on a heritage of achievement.

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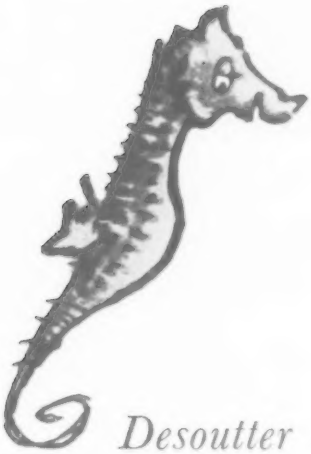

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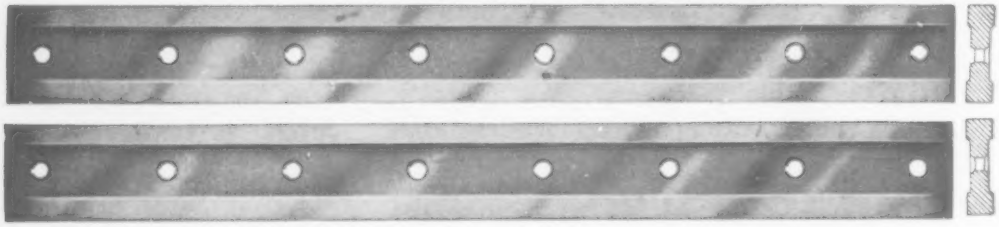

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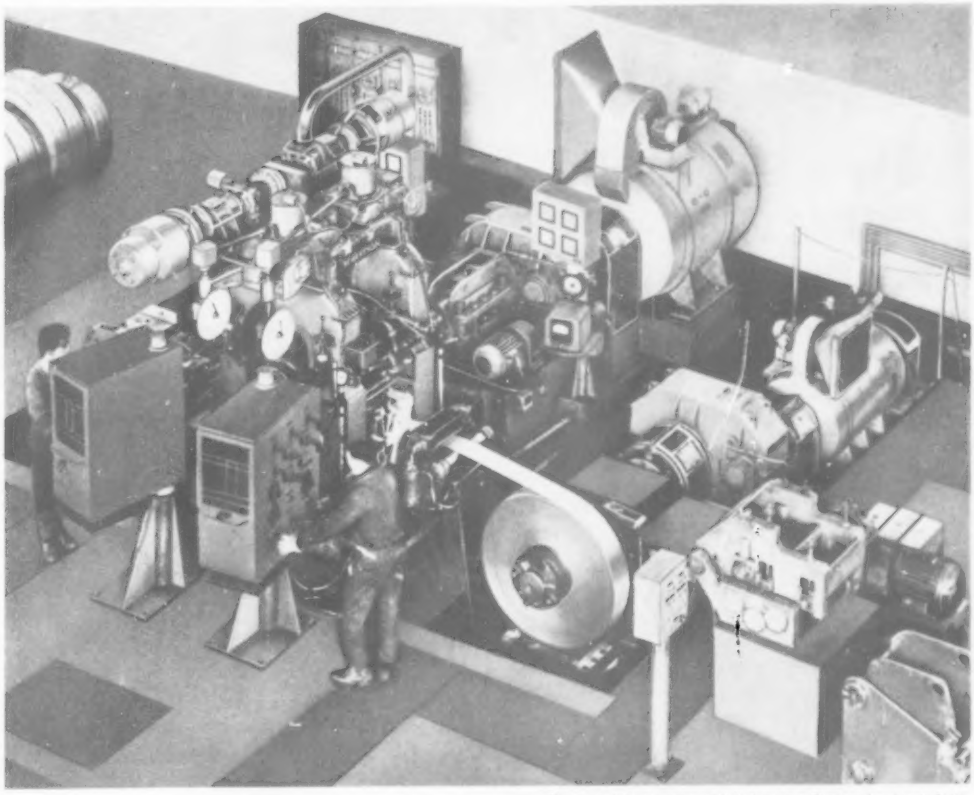

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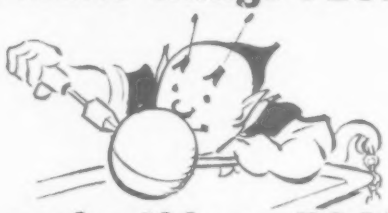

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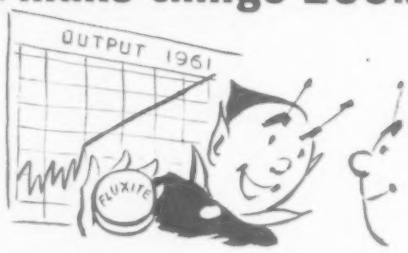

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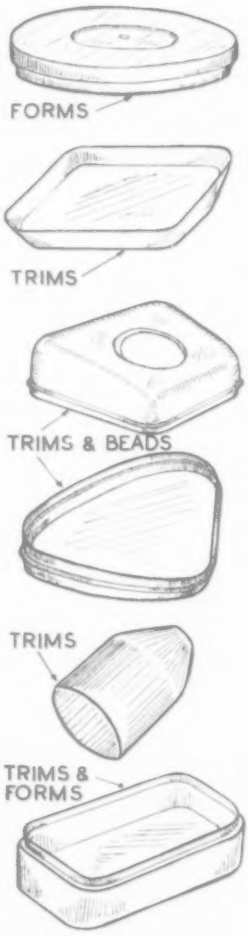

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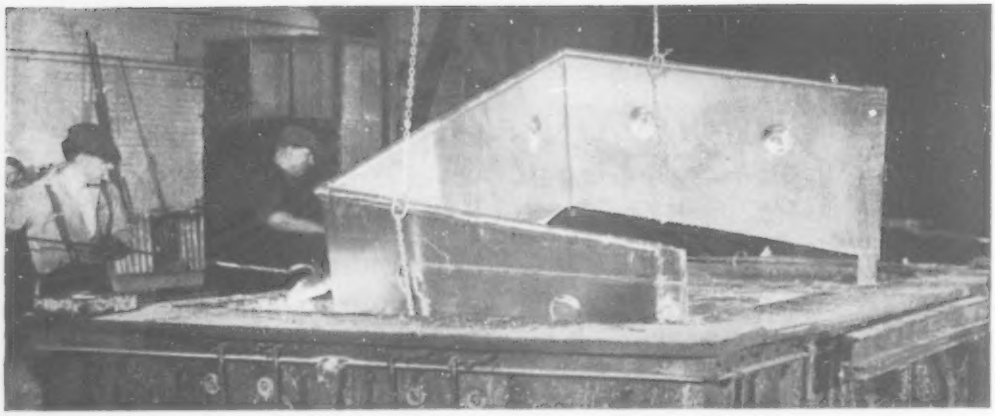

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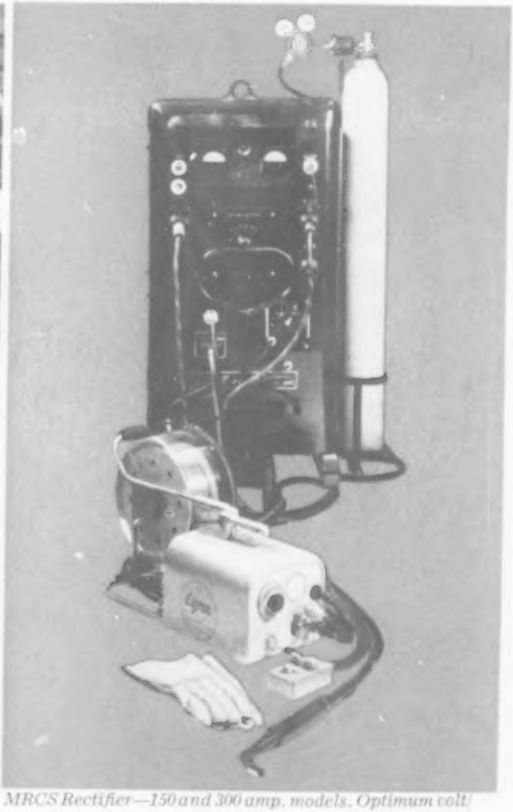

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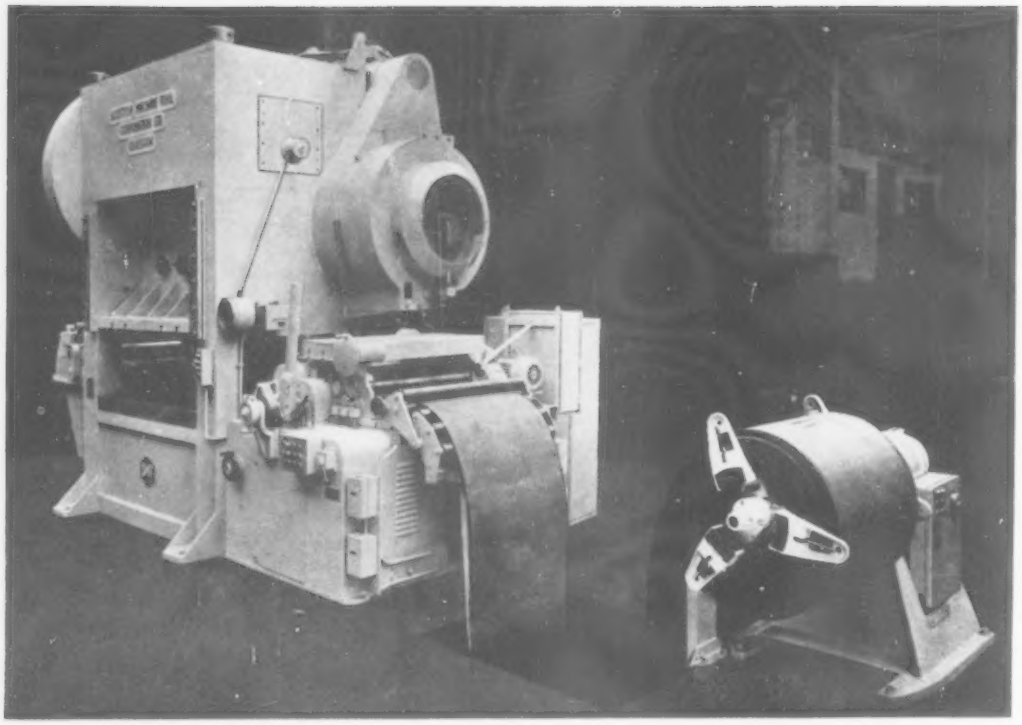

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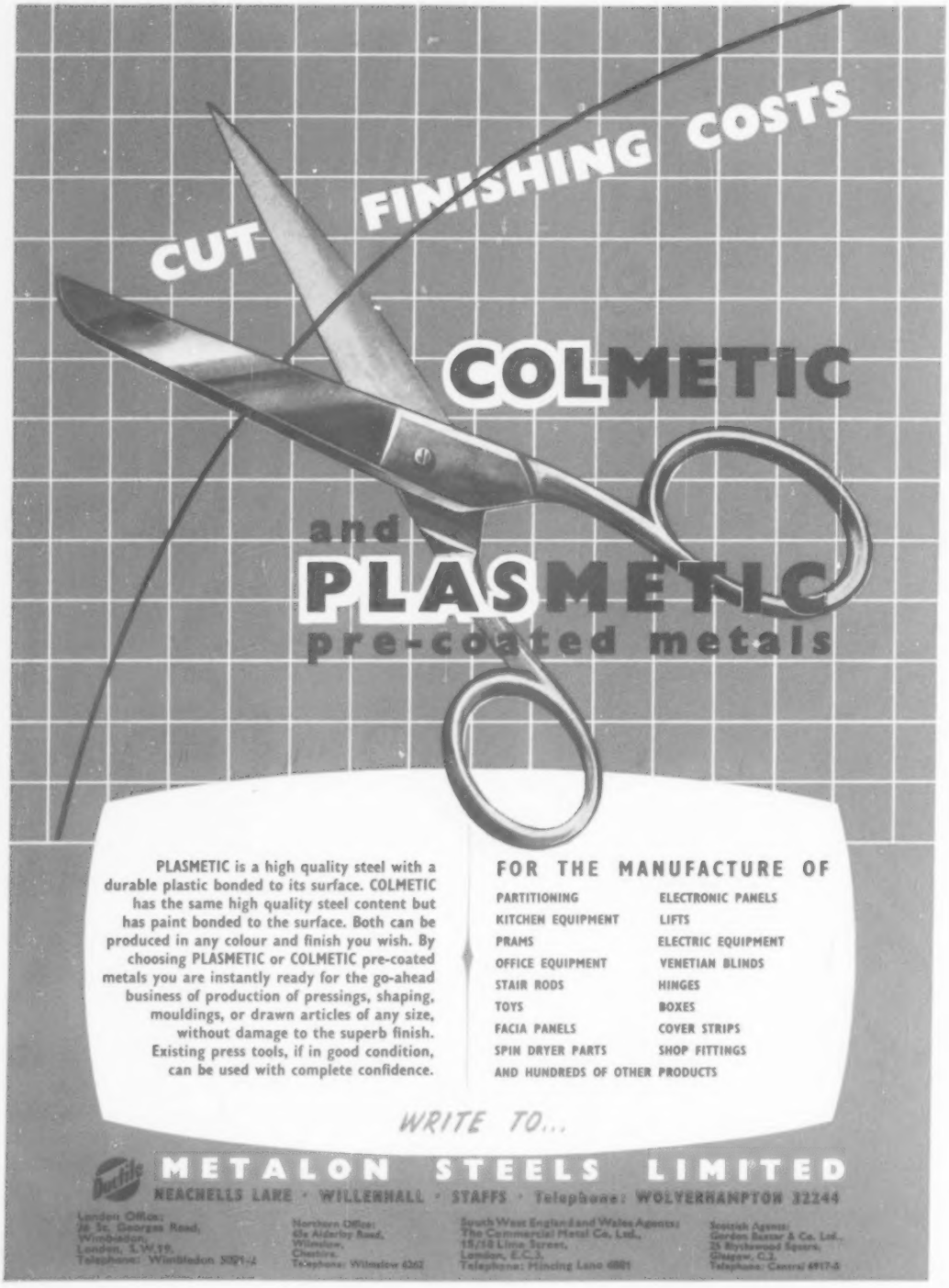

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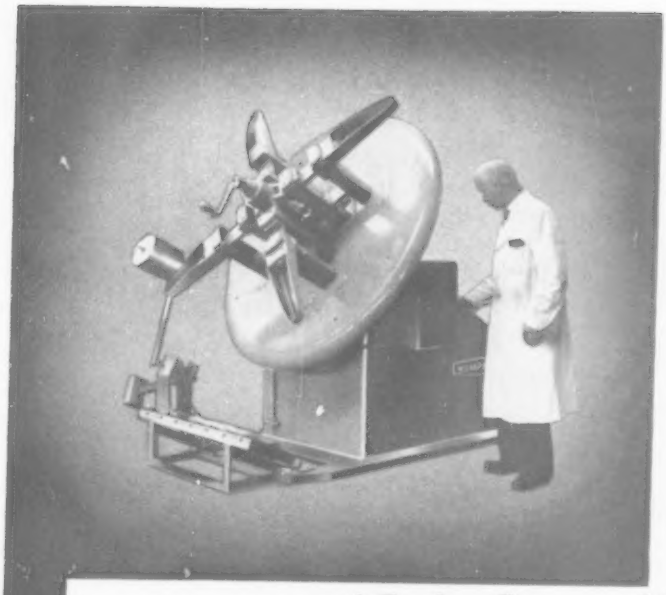

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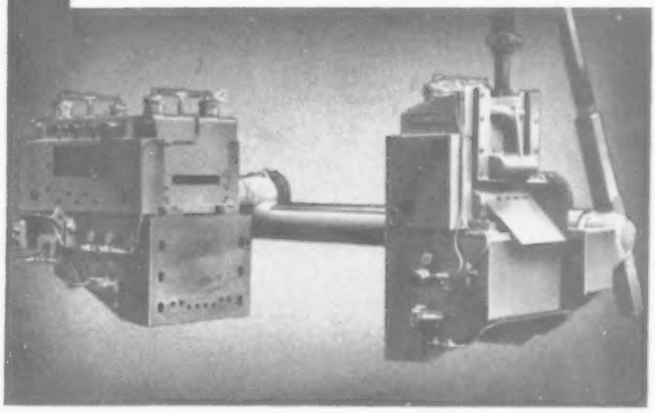

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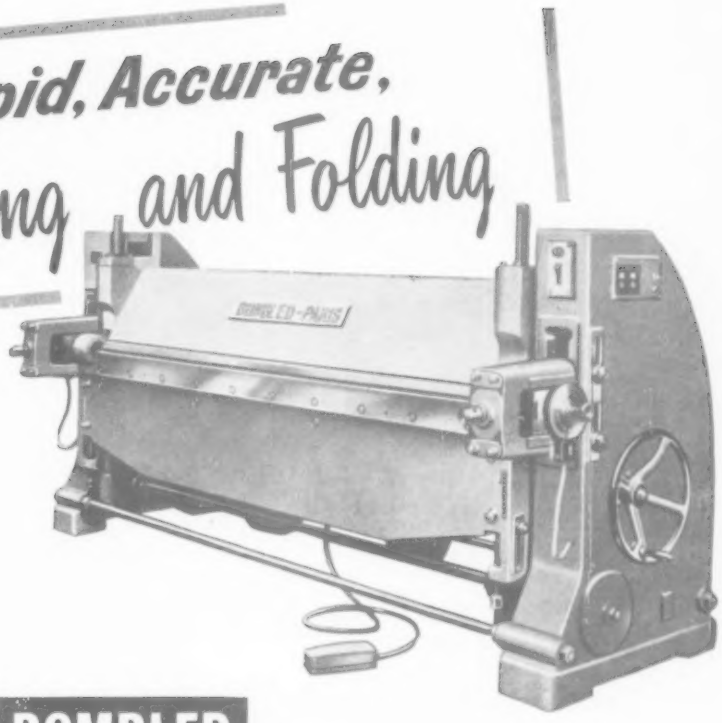

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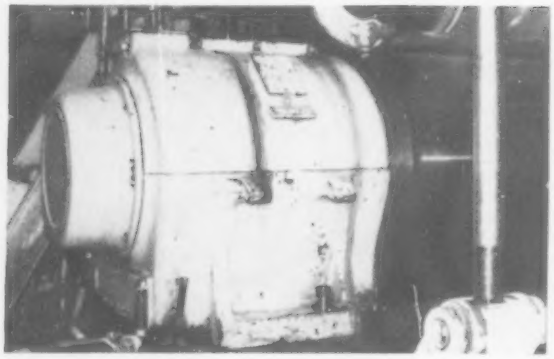

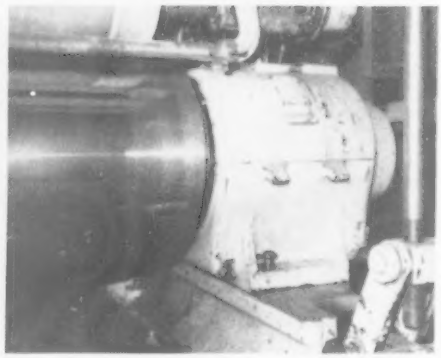

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Due to Heavy load and mishap whereby water entered the oil system supplying two white-metal bearings, 15" in diameter, 17½" long, carrying the bottom roll on a Supercalender, a hot bearing developed and the white metal "ran". Total loading on each bearing was 77,200 lbs.

Extracts from letter received from:—
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(Member of the Reed Paper Group)

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This bearing ran successfully for many weeks, thus avoiding a major shut-down at a busy period.

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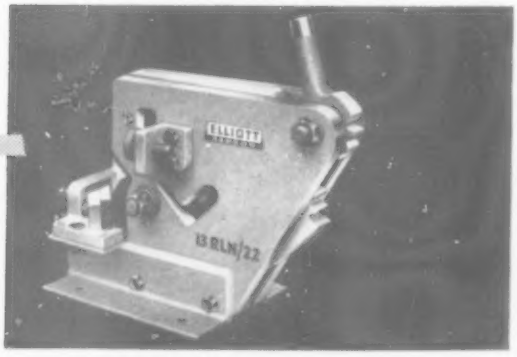

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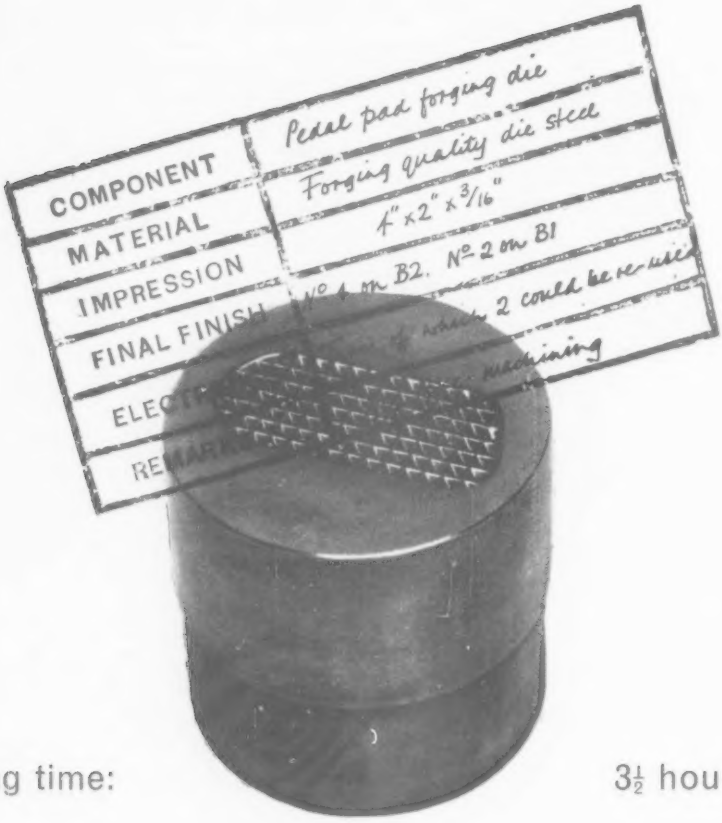

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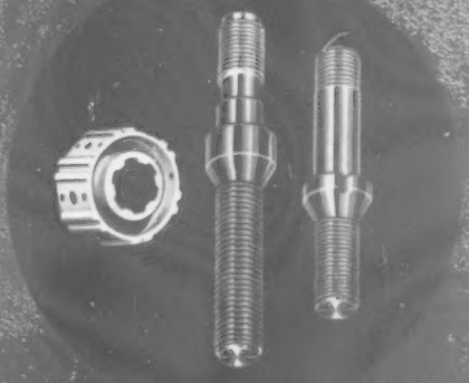

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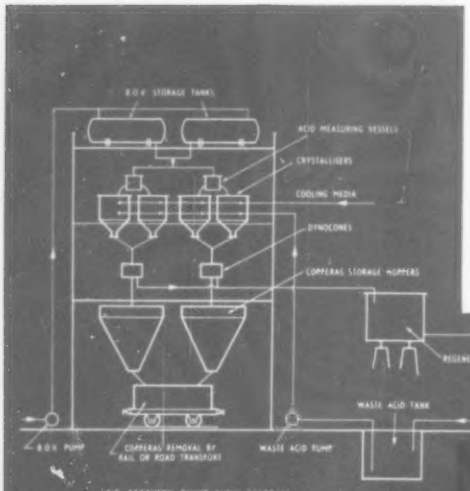

ACID RECOVERY PLANT FLOW DIAGRAM

The sulphuric acid regeneration plant recently installed by John Thompson (Dudley) Ltd., at the new Brinsworth Mill of Steel, Peech & Tozer, is probably the largest of its kind in this country. The complete plant is capable of treating all spent pickle liquors from the continuous strip lines in the mill, and provision has been made for doubling the capacity of this plant at a future date to meet the demand when the mill is working at maximum capacity.

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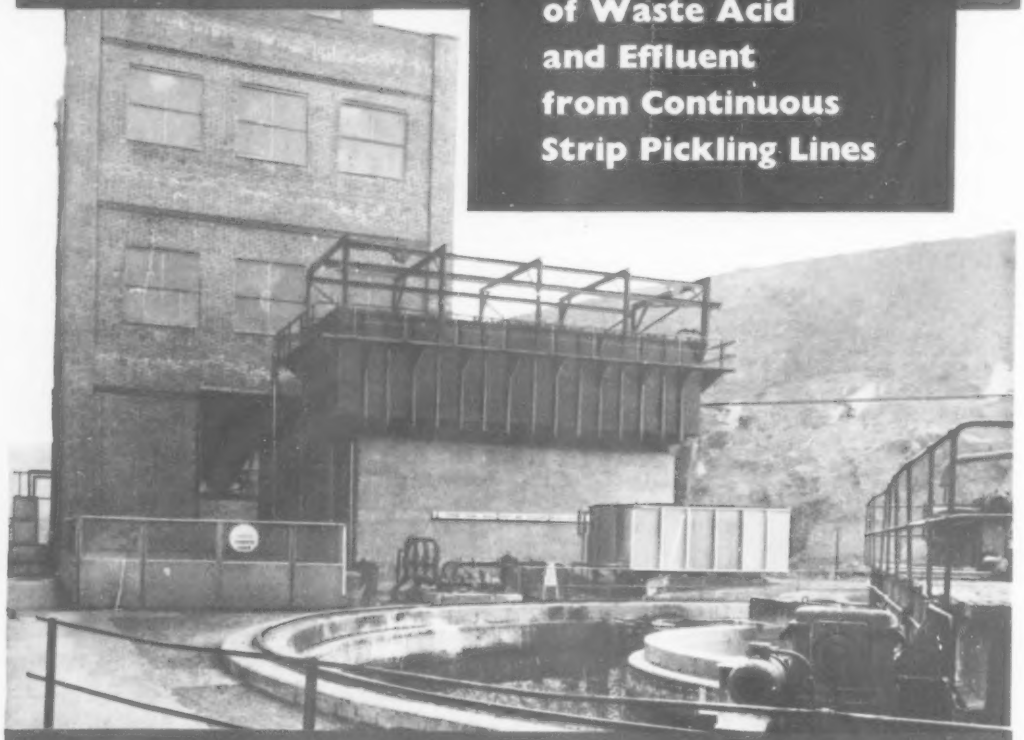
Treatment of Waste Acid and Effluent from Continuous Strip Pickling Lines



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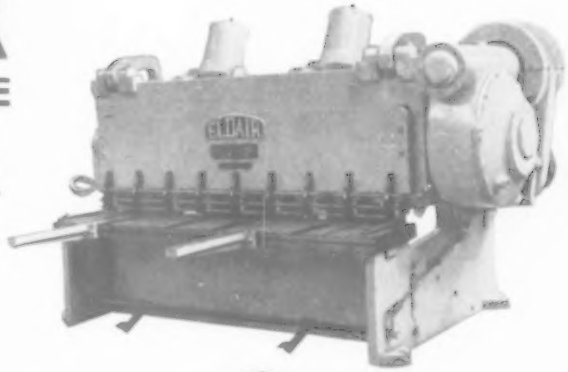

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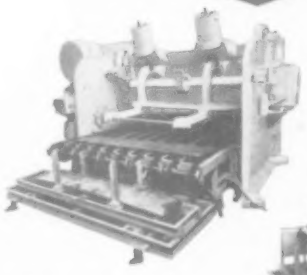

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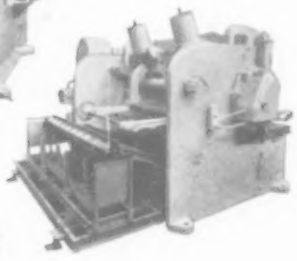

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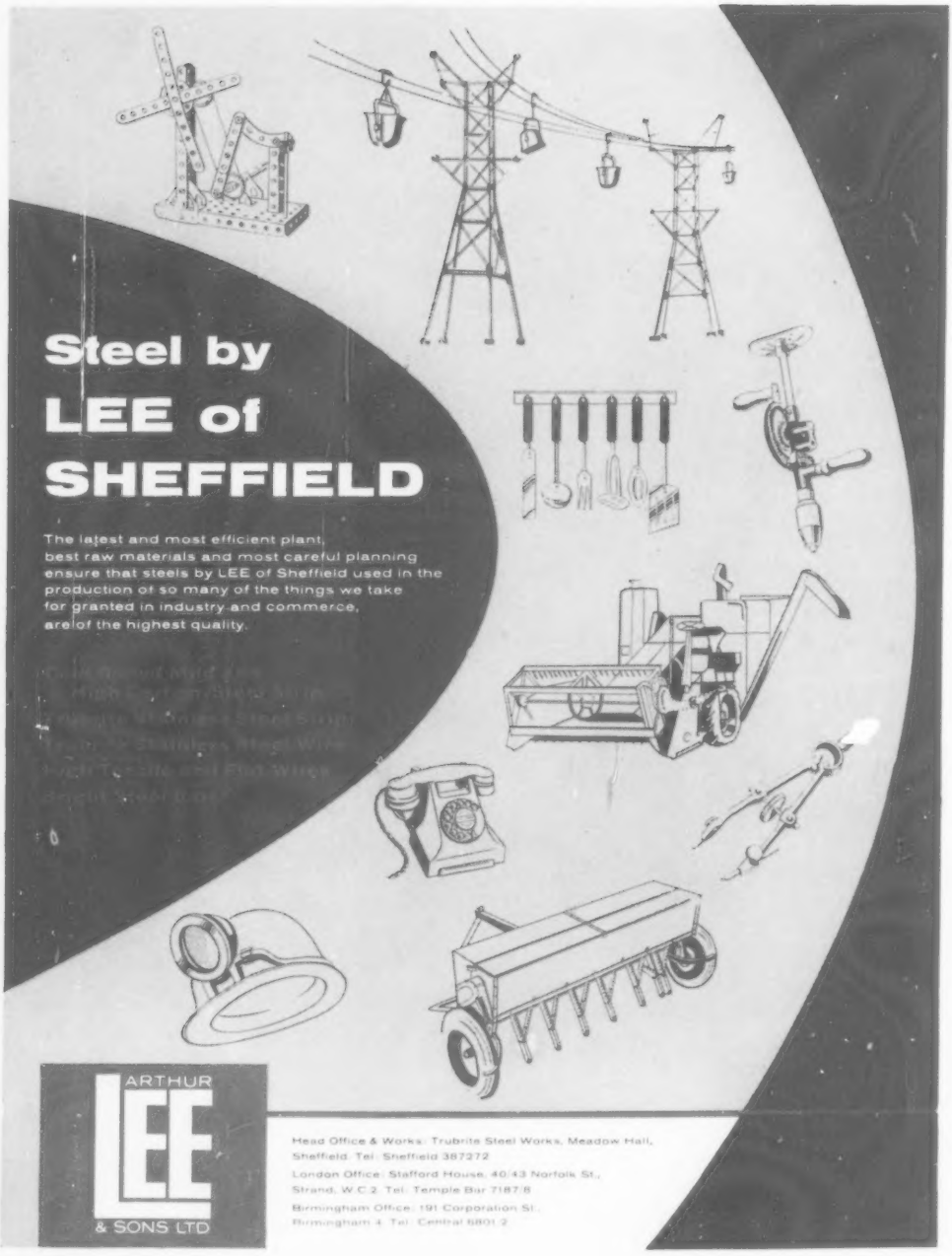
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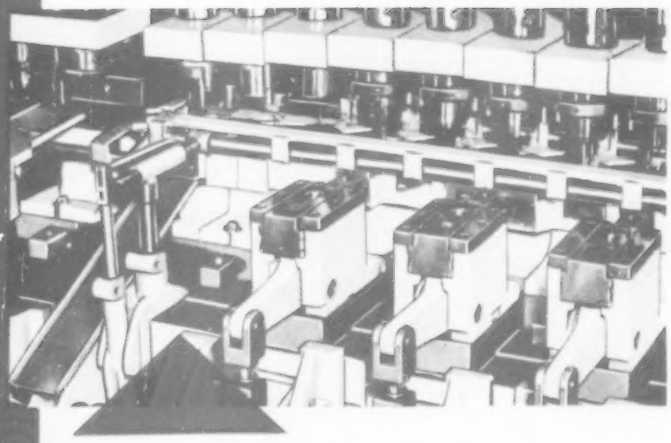

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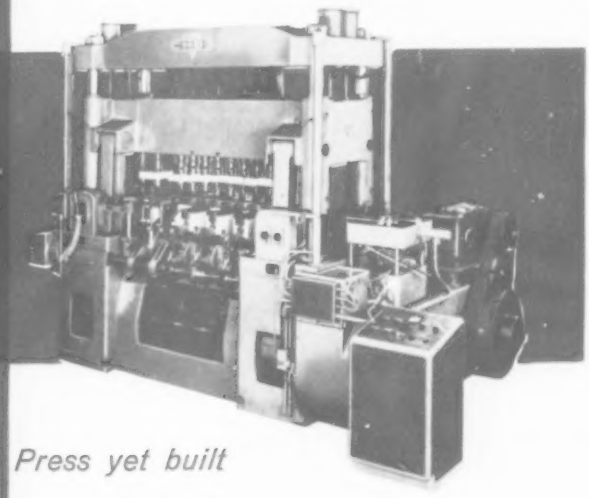

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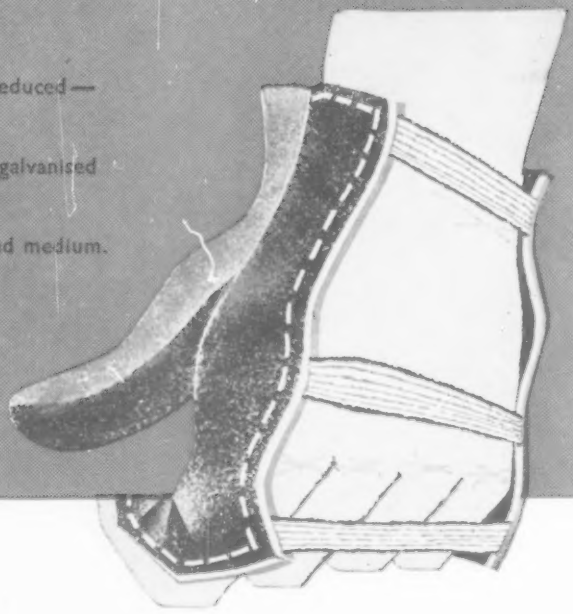

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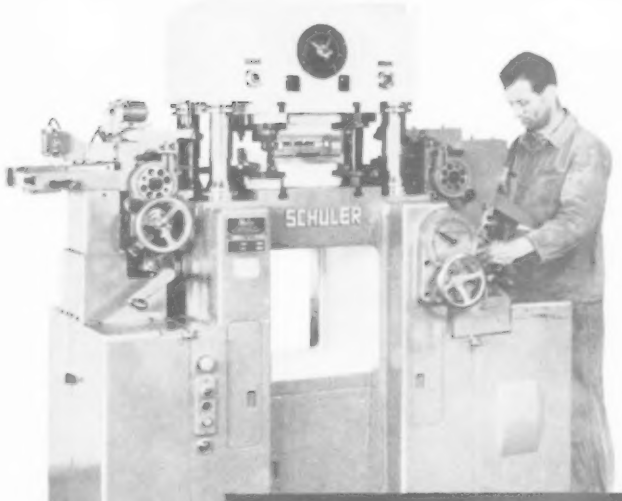

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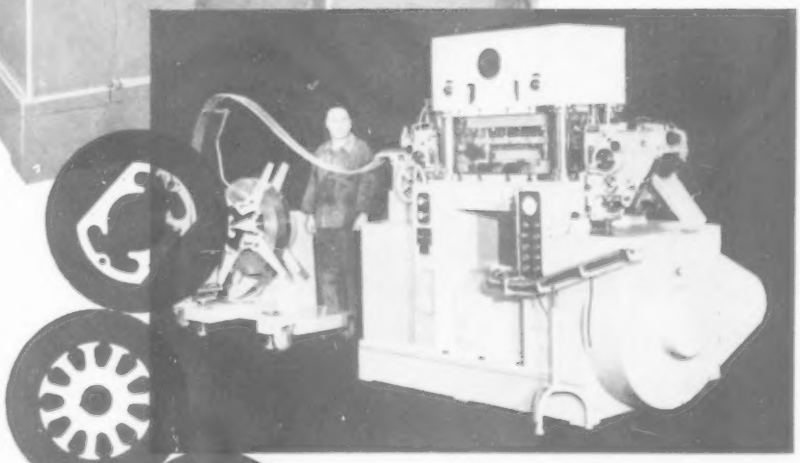

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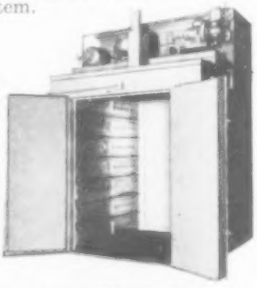

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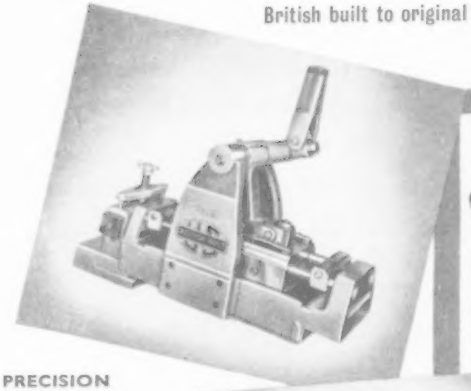

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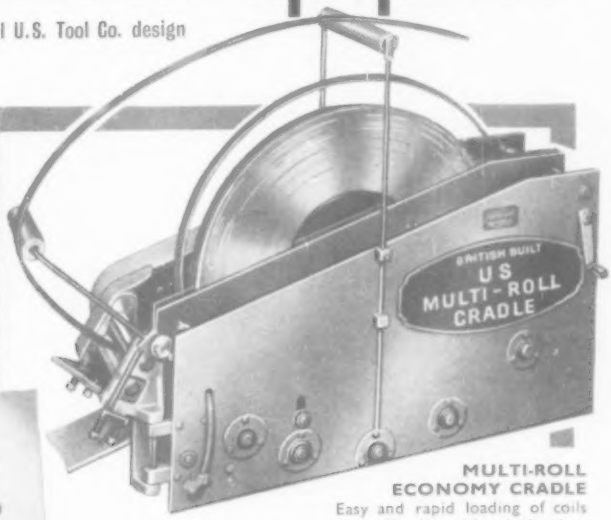

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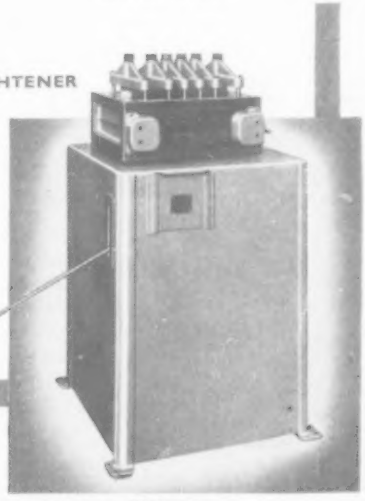

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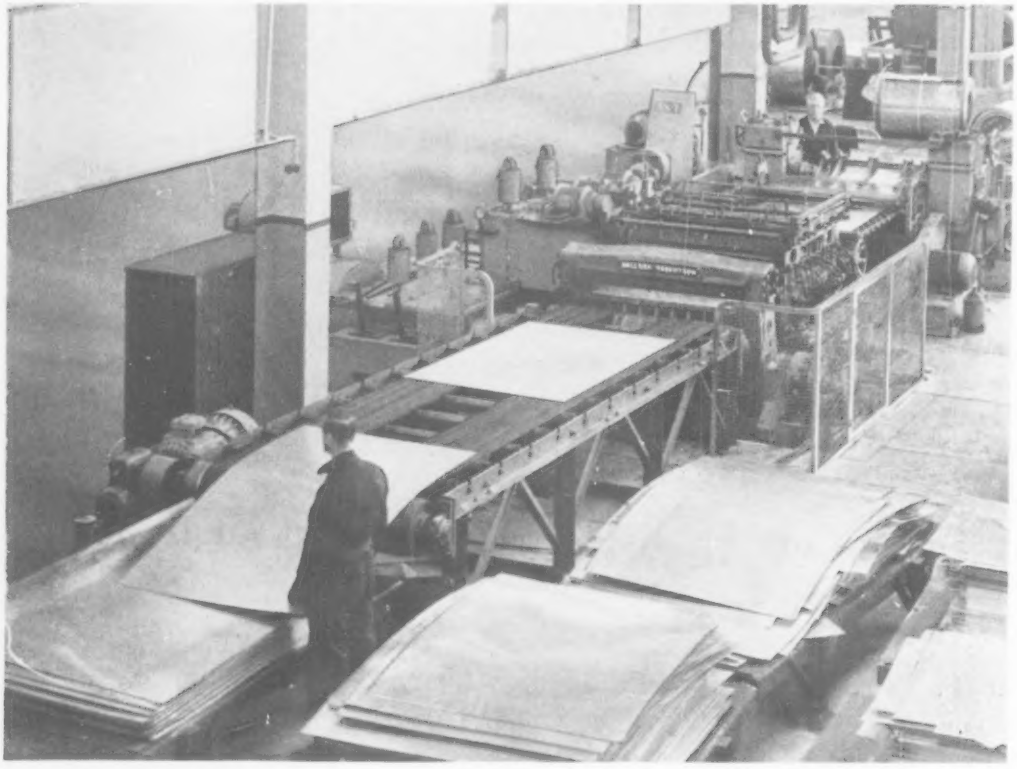

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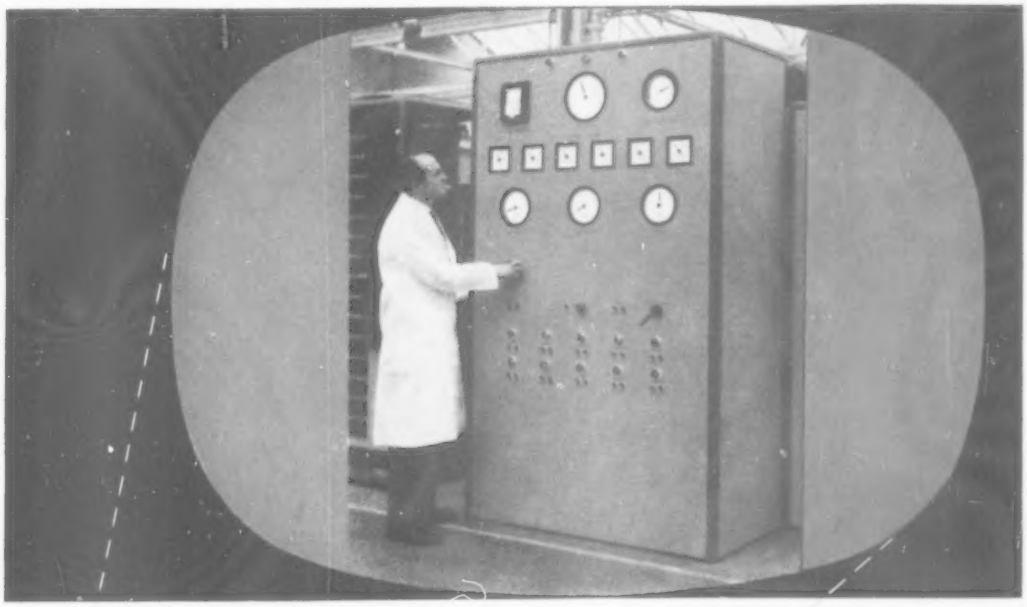

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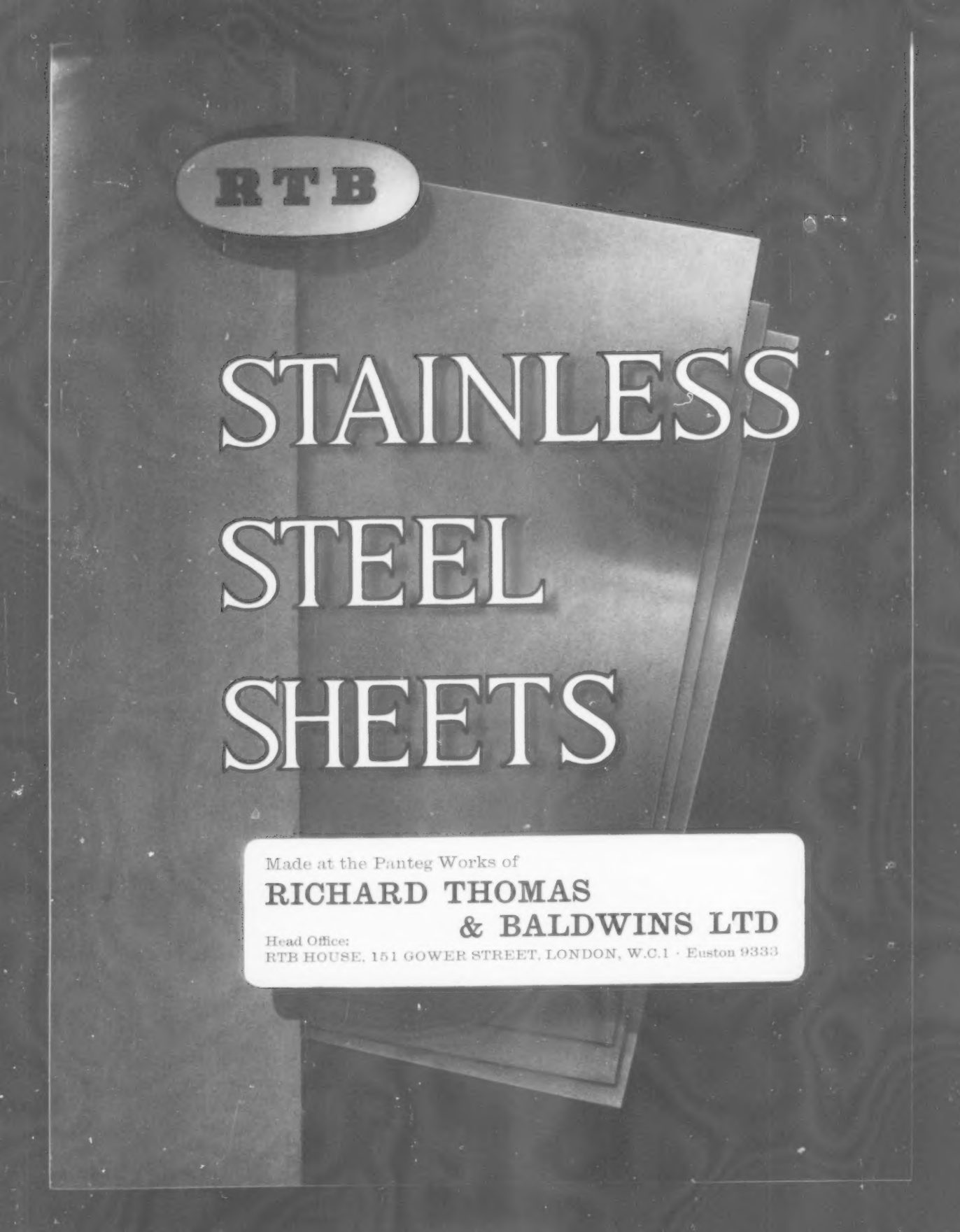

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DECEMBER 1961
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Methods of Rating Power Presses 895
E. Hamilton

The above three papers were presented at the first technical session of the annual conference of the Institute of Sheet Metal Engineering, held in Birmingham from November 7 to 9, 1961. The first paper deals with types of dry-film lubricants, application techniques, the compatibility of dry-film lubricants with certain metals, comparison with conventional lubricants, and economic aspects. The second paper discusses the selection of a tool steel and makes particular reference to medium-alloy steels. The third paper is confined to mechanical presses and discusses energy rating or work capacity and speed of operation. The discussion following the presentation of the papers is included.

Redbrook Tinplate Works 899
Tom Grey-Davies
A brief description of the last of the hand tinplate rolling mills which closes this month. This works is unique, not only because of its location (in the Wye Valley) but also because it was perhaps the first to use steam, and then electric, power drives.

Questions and Answers in Press Tool-making 901
J. V. Harding
Some comments on the subject of examination technique with examples from the City and Guilds of London Institute's Examinations.

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The "College-Internationale-Recherches-Production" (C.I.R.P.). A review of its Aims and Objects 906
By Prof. Dr.-Ing. O. Kienzle
The C.I.R.P. first met in Paris in 1951 and have met annually since that time, 15 to 25 papers on production engineering problems usually being presented at each meeting. Membership of the Association now involves 17 countries.

The High-speed Production of Refrigerator Cabinets 909
Some details of two typical manufacturing methods in use in the United States of America.

Predetermination of the Deep-Drawing Capacity of Light Sheet Metal on the Basis of Laboratory Tests and the Development of a Drawn Prototype representing Car Body Panels 911
M. Jentet
An earlier investigation (1954) had established the correlation between various conventional tests and the results obtained in the deep drawing of a cup, using as a characteristic the maximum blank diameter which can be drawn without tearing (critical diameter).
These tests showed that by improving the tooling so as to facilitate metal flow, the deep-drawing capacity of a blank of given diameter becomes more independent of the conventional characteristics of the sheet-metal used.
This law was only demonstrated in the case investigated, i.e. with a very simple drawn part, for which the technological conditions of the test might be more important than the actual form of the part, and such conditions do not obtain in the case of car-body stampings.
It is for this reason that a more complicated drawn part has been used by the author while still retaining a form which lends itself to rigorous evaluation of the results obtained.

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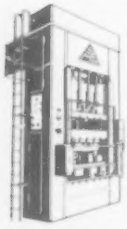

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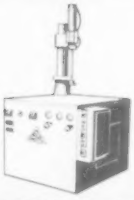

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FOR OUR OVERSEAS READERS

RÉSUMÉS DES PRINCIPAUX ARTICLES

L'utilisation de lubrifiants à pellicules sèches solubles dans l'eau, pour le laminage profond de métaux ferreux

page 865

Par J. Clarke.

Aciers à outils pour le fabrication de blancs et le travail à la presse .. page 881

Par A. W. F. Comley, A.I.M., M.Ins.W., M.I.E.I., A.Inst.Prod.E.

Méthodes de contrôle pour les presses Mécaniques

page 895

Par E. Hamilton.

Les trois mémoires ci-dessus ont été présentés à la première session technique de la Conférence annuelle de l'Institute of Sheet Metal Engineering, qui s'est tenue à Birmingham du 7 au 9 novembre 1961. Le premier mémoire traite des types de lubrifiants à pellicules sèches, de leurs techniques d'application, de la compatibilité des lubrifiants avec certains metaux, de la comparaison avec les lubrifiants conventionnels, et de leurs aspects économiques. Le deuxième mémoire examine la sélection des aciers à outils et traite en particulier des aciers d'alliage moyen. Il traite des défaux et considère le traitement des surfaces des aciers à outils. Le troisième document est limité aux presses mécaniques et traite du contrôle d'énergie ou capacité de production et de la vitesse d'opération. Le débat qui a suivi la présentation de ces mémoires est incluse.

Le "Collège-International-Recherches-Production" (C.I.R.P.). Revue de ses buts et objectifs .. page 906

Par le Prof. Dr.-Ing. O. Kienzle.

Le C.I.R.P. s'est réuni à Paris pour la première fois en 1951; il s'est réuni depuis tous les ans. En général, on fait entre 15 et 25 communications au sujet de la production technique à chaque réunion. Les membres et les membres-associés représentent actuellement 17 pays; un grand nombre de projets sont en cours, y compris un dictionnaire technique international qui sera rédigé en français, en anglais et en allemand.

(*Suite page 920*)

ZUSAMMENFASSUNGEN DER HAUPTARTIKEL

Die Verwendung von wasserlöslichen Trockenfilm-Schmierstoffen beim Tiefziehen von Eisenmetallen

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Von J. Clarke.

Werkzeugstähle für das Schnellstanzen und -pressen

Seite 881

Von A. W. F. Comley, A.I.M., M.Inst.W., M.I.E.I., A.Inst.Prod.E.

Methoden zur Leistungsbestimmung von Pressen

Seite 895

Von E. Hamilton.

Diese drei Vorträge wurden auf der ersten technischen Sitzung der vom 7. - 9. November 1961 in Birmingham stattgefundenen Jahreskonferenz des Institute of Sheet Metal Engineering gehalten. Der erste beschäftigt sich mit verschiedenen Arten von Trockenfilm-Schmierstoffen, mit Anwendungsverfahren, mit der Verträglichkeit von Trockenfilm-Schmierstoffen mit gewissen Metallen, er gibt einen Vergleich mit den herkömmlichen Schmiermitteln und bringt wirtschaftliche Gesichtspunkte. Der zweite behandelt die Wahl eines Werkzeugstahls und berücksichtigt besonders die mittellegierten Stähle. Außerdem wird auf Fehler in Werkzeugstählen und auf Verfahren der Oberflächenbehandlung eingegangen. Der dritte Vortrag befaßt sich speziell mit mechanischen Pressen und behandelt die Bestimmung ihrer Leistungsfähigkeit und Arbeitsgeschwindigkeit. Die den Vorträgen folgende Diskussion ist eingeschlossen.

Das "Collège-Internationale-Recherches-Production" (C.I.R.P.). Ein Uberblick über Zweck und Ziel Seite 906

Von Prof. Dr.-Ing. O. Kienzle.

Das C.I.R.P. trat 1951 erstmalig in Paris zusammen und tagt seitdem alljährlich. Auf jeder Tagung werden gewöhnlich 15 bis 25 Vorträge über Probleme der Verfahrenstechnik gehalten. Die Mitgliedschaft erstreckt sich gegenwärtig auf 17 Länder, und es laufen viele Projekte, u.a. die Herausgabe eines internationalen technischen Wörterbuches in drei Sprachen, Französisch, Deutsch und Englisch.

(*Forts. S. 920*)

RÉSUMENES DE LOS ARTICULOS PRINCIPALES

El empleo de lubricantes de película seca soluble en agua en el estampado profundo de metales ferrosos página 865

Por J. Clarke.

Aceros para herramientas para punzonar y estampar a alta velocidad página 881

Por A. W. P. Comley, A.I.M., M.Inst.W., M.I.E.I., A.Inst.Prod.E.

Métodos para clasificar prensas mecánicas página 895

Por E. Hamilton.

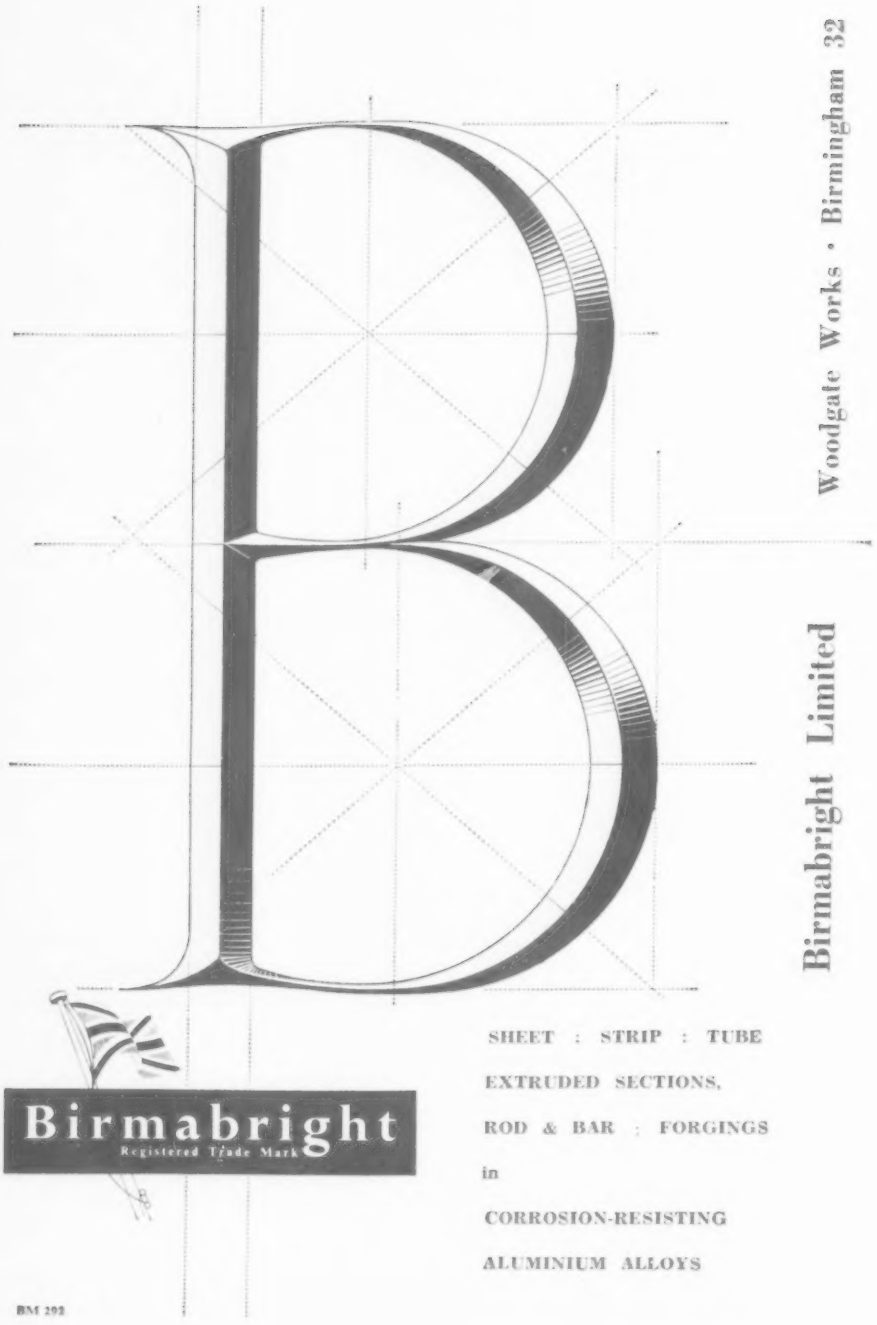
Las tres ponencias arriba indicadas fueron presentadas durante la primera sesión técnica de la Conferencia anual del Instituto de Ingeniería de la Chapa Metálica, celebrada en Birmingham durante los días 7 a 9 de noviembre de 1961. El primer trabajo trata de lubricantes del tipo de película seca, los sistemas de aplicación, la compatibilidad de los lubricantes de película seca con ciertos metales, su comparación con los lubricantes corrientes y de los aspectos económicos. La segunda ponencia se refiere a la selección de acero para herramientas y muy particularmente a los aceros de aleación mediana. También trata de los defectos y estudia los tratamientos superficiales para aceros para herramientas. El último documento está limitado a las prensas mecánicas y trata de la clasificación por energía o capacidad de trabajo y velocidad de funcionamiento. También se acompaña la discusión a que dió lugar la presentación de las ponencias.

El "Collège International Recherches Production" (C.I.R.P.). Pasando revista a sus aspiraciones y objetivos página 906

Por el Prof. Dr.-Ing. O. Kienzle.

La C.I.R.P. celebró su primera reunión en París en 1951 y desde entonces se reunido una vez cada año, sometiéndose, en general, de 15 a 20 ponencias sobre problemas de ingeniería durante cada sesión. Cuenta ya la Asociación con miembros de 17 países y se hallan ya en vías de ejecución muchos proyectos, incluso uno que trata de un diccionario técnico internacional que ha de publicarse en Francés, inglés y alemán.

(*Continuara en p. 920*)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SO MUCH, SO FEW

ONE of the problems that stems directly from the increasing complexity of present-day science and technology is to define the boundaries between the fields of interest of different operators. In the good old days no one would have had any great difficulty in deciding what was the proper domain of a chemist, a physicist, a biologist or an engineer; indeed, it was manifestly possible and proper to distinguish between a mechanical, automobile, civil, structural, and marine engineer.

Today a biologist is three parts chemist, a chemist is nine-tenths physicist and the differentiation between the engineering fields appears to have dwindled to such insignificance that the possibility is being mooted of bringing all engineers together under one major Institutional umbrella.

The pattern of human history reveals a clear cycle of integration followed by disintegration and it would seem that this pattern is repeated on a lesser scale in other areas of human activity. Thus we have passed from the great all-embracing scientific fraternities of the eighteenth century to the present diversity of specialist splinter groups catering for every imaginable sub-division of scientific knowledge. The dangers of this degree of intimate specialization are now coming to be fully appreciated and the current opinions being voiced in favour of rationalization and rapprochement may well mark the commencement of the return swing of the pendulum.

Those who have played any part in the promotion of international collaboration in scientific and technological research and investigation will have become increasingly aware in recent years of the existence of a body known somewhat nebulously by the initials C.I.R.P. It has not always been abundantly clear just what C.I.R.P. is, nor how it operates and what might be its purposes, so we are happy to shed more light on this body in an article elsewhere in this issue, contributed by Professor O. Kienzle, who was one of those who played a leading part in its foundation.

Briefly, it would appear that C.I.R.P. is an association of individuals eminent in the field of production engineering, drawn from some seventeen countries. Plenary meetings are held once a year when members and associates hear and discuss papers on topical production engineering subjects and visit works and laboratories.

In these respects C.I.R.P. does not differ greatly from other international scientific bodies except in one significant particular. Membership is on an individual basis and the number of individual full members permitted to each country is strictly limited—in the case of the U.K. it is understood the maximum is six. One recent activity of the Association has been to put forward programmes for co-ordinated research on metal-working subjects throughout the European community. While the value of such a programme may be indisputable it does seem fair to question whether the very restricted membership of C.I.R.P. is best placed to ensure that all those, at any rate in the U.K., who could make an effective contribution to such a programme are able to participate.

INSTITUTE OF SHEET METAL ENGINEERING

Forthcoming and Recent Events

One-day Colloquium on

SHEET METAL TESTING

London, December 19, 1961

UNDER the aegis of the Test Panel of the British Deep Drawing Research Group a one-day Conference will be held at the City and Guilds College on December 19, 1961, devoted to the presentation and discussion of a number of papers relating to important aspects of sheet metal testing. The testing of sheet metal with a view to predicting its behaviour under the press has been fast assuming great significance in industry throughout the world, and the appraisal of established tests as well as the quest for improved ones has been the major occupation of the panel in recent years.

The papers to this Conference will not be preprinted but will be presented in full at the meeting, which will provide an invaluable opportunity for full discussion on this vexed topic, the proceedings of which will *not* be recorded. The inclusive cost of participation in the Colloquium is £1 5s., covering attendance at all sessions, luncheon, morning coffee, and tea. Non-members of the Institute of Sheet Metal Engineering may attend, subject to accommodation being available, on payment of an enrolment fee of 10s. 6d.

Application forms for tickets have been circulated to all members of the British Deep Drawing Research Group and of I.S.M.E. Others interested in attending should apply to the Hon. Secretary, I.S.M.E., John Adam House, John Adam Street, London, W.C.2.

PROGRAMME

9.30 a.m. Opening remarks by the chairman of the Deep Drawing Research Group, Dr. J. G. Wistreich (British Iron and Steel Research Association). 1st Session. **Metal Properties Relevant to the Forming of Sheet Metal**—introduced by Dr. J. M. Alexander (Imperial College).

10.45 a.m. Break for Coffee.

11.00 a.m. 2nd Session. **Factors of Importance in Simulative Testing**—introduced by Dr. J. F. Wallace (Pressed Steel Co. Ltd.)

12.00 a.m. 3rd Session. **The Tensile Test as a Guide to Forming Properties**—introduced by R. Pearce (College of Aeronautics).

1.00 p.m. Luncheon.

2.00 p.m. 4th Session. **Current Views on the Scope and Application of the Swift Test with some reference to other Cupping Tests**—introduced by Dr. D. V. Wilson (Birmingham University).

3.00 p.m. 5th Session. **Appraisal of Current Information on the Erichsen Test**—introduced by L. Hawtin (I.C.I. Ltd., Metals Division).

4.00 p.m. 6th Session. **Appraisal of Current Information on the Olsen Test**—introduced by D. H. Lloyd (Fisher and Ludlow Ltd.)

5.00 p.m. Tea and Conversazione.

6.00 p.m. Colloquium ends.

SPECIAL CONFERENCE ON HIGH-ENERGY FORMING

Arrangements are now being completed for a Special Conference to be held in London in April, 1962, for the discussion of papers relating to processes of producing sheet metal components by the use of high-energy sources. The Conference will cover all variants of explosive forming and kindred processes and it is proposed to devote one session to a discussion of some of the more significant effects on metals of deformation at high rates of strain.

Invitations to contribute to this conference have been sent to a number of eminent workers in this field in various countries and it is evident that much work on the subject has now reached the stage where it will benefit from full discussion.

Any interested in submitting a paper to this meeting should communicate immediately with the Hon. Secretary, High-Energy Forming Sub-Committee, I.S.M.E., John Adam House, John Adam Street, London, W.C.2.

MIDLAND BRANCH WORKS VISIT

SO many members applied to visit the Bilston Works of Stewarts and Lloyds Ltd., that three separate visits had to be arranged. Visitors were shown a technical film on arrival and, on at least one of the days, were fortunate enough to see the tapping of a blast-furnace. The open-hearth furnaces and the rolling mills etc. were also seen. The guides were apprentices who had a good grasp of the processes involved.

The Use of

WATER-SOLUBLE DRY FILM LUBRICANTS IN THE DEEP DRAWING OF FERROUS METALS

By J. CLARKE*

(*A paper presented at the Annual Conference of the Institute of Sheet Metal Engineering, held in Birmingham, November 7 to 9, 1961*)

Introduction

DRY-FILM lubrication in drawing and press-work operations on sheet metal has moved into a wider range of usage over the last few years in the United States. More recently this technique has aroused interest in the United Kingdom and is now becoming established in industrial use. The intention here is to give an outline survey of practice and technique based on current industrial experience in the United Kingdom. Due to the comparatively recent introduction of dry-film lubrication into this country, this is by no means exhaustive, but it is hoped that some reference to practice in the U.S.A. will provide amplification where necessary.

It is a matter of some doubt whether such techniques will be exploited here to the same extent as in the U.S.A. due to the relatively smaller number of undertakings engaged in high-volume production of pressed components. However, there can be little doubt that future expansion in the field of domestic appliances for example, accompanied with a greater degree of automation, will lead to a wider use of dry-film lubricants. The increasing public demand for higher-grade finishes at low price combined with good aesthetic design is a further factor suggesting that flow-line production of pressings will require to be linked with a flow-line method of lubrication. The dry-film techniques are ideally suited for this purpose and also meet the requirements associated with the enlightened industrial welfare outlook.

The change-over to dry-film lubrication involves a fundamental alteration in attitude towards lubrication, a comparatively minute facet of metalware production. Since in many instances the capital equipment required for using conventional wet lubricants consists of a tin can and a piece of rag, any suggestion of replacing this with automatic equipment costing several thousand pounds is a matter for deep investigation. Circumstances where installation of the process can be economically justified will vary widely, but are usually where a direct increase in productivity of labour, equipment or material can be achieved. Functional performance of drawing lubricant may be an entirely separate reason for considering such a process, apart from economic and other advantages gained. Conversely, there are many presswork applications where good lubrication, or the lack of it, are not in the least critical. The economic limitations of dry-film lubrication are apparent when it is considered that such applications invariably involve comparatively low-grade components for highly competitive markets.

* R. Cruickshank Ltd.

Types of Dry-film Lubricants

There are several types of dry films in industrial use as lubricants for press-forming and deep drawing of sheet. These include the use of light-weight polythene sheet and those instances where the sheet has its own "built-in" dry lubricant, usually incidental to the main purpose as in tinplate, and plastic-coated or galvanized sheet. Usually, however, the lubricant is applied to bare steel from a proprietary compound. One common type of such compound consists of waxes, resins or chemically similar substances dispersed in air-drying solvents to produce dry lubricating films which are not water-soluble. The other type of compound relies on heat drying for the production of the dry film, which is water soluble and it is this type of compound under present consideration. The practical definition of "dryness" is difficult but certainly the heat-dried films are drier to touch. It is the property of water solubility which, in practice, classifies two distinctly different types of dry-film lubricants.

Before dismissing the water-insoluble dry-film lubricants, the following observations are made so as to enable comparison when the relevant points concerned with the water-soluble compounds are made later.

(1) The application of water-insoluble compounds may not involve heating the sheet metal.

(2) It is not usual or very practicable for a cleaning operation to precede lubricant application. Where this is carried out the operation is confined to solvent degreasing.
(3) The production of a reasonably dry film often requires several minutes drying time.
(4) The compound can be applied at the press but immediate use usually sacrifices a degree of film "dryness".
(5) In an operation involving heat generation, toxic solvent vapours may be evolved.
(6) Lubricant transferred to tools tends to build up in thickness.
(7) Lubricant removal from components is by solvent degreasing with no necessity to wet with water.

Such observations are extremely general when the variety of commercially available compounds is considered, but it is felt that at least some of the comments will hold good for any individual compound of this type. As the water-soluble films are not so chemically divergent in formulation, some comparison should be possible.

The water-soluble dry-film lubricants can be divided into those which are applied from heated solutions and those which are applied from a solution at room temperature. In each case the definitive criterion is that both the make-up chemical and the dried film are truly water-soluble. This will, therefore, preclude from consideration the large number of compounds which are emulsified or dispersed in water to produce a "semi-dry" lubricating barrier. The heat-dried wax-type dry films are similarly precluded, as are the insoluble soap films commonly used in conjunction with phosphate coatings.

The dry-film compounds applied from heated solutions are by far the more widely used, chiefly because compared with the cold-applied solutions they are:—

(*a*) much cheaper,
(*b*) functionally superior,
(*c*) more versatile in performance, and
(*d*) more economical in heat-drying requirements.

The heated solutions have the common chemical basis of an alkaline soap but with such a loose definition, the commercially possible variations are infinite. The physical properties of the solution and the resultant film will depend on the choice of alkali, the metallic and organic basis of the soap and the quantity ratio between soap and alkali. The purity of the soap can have a marked effect on melting point which is often a critical characteristic in a dry lubricant for deep drawing. However, the melting point and other physical properties of the composite film can be readily manipulated by small quantities of various addition agents and it is generally in such refinements that differences in proprietary compounds occur. In practice, the differences between proprietary compounds fall into a very narrow range because:—

(*a*) Performance is largely pre-determined by the technical requirements of the metal-working industry.
(*b*) Economy demands use of the cheapest soap consistent with good performance (*e.g.* sodium stearate).
(*c*) Since heat drying is necessary there is little point in developing a solution which is stable below the temperature range 170° F. to 212° F.

From the operational point of view, the difficulty is to select a lubricant suitable for use on as wide a range of components as possible. This may necessitate the use of more than one compound, but in most instances it is possible to modify operating conditions of application to produce the required versatility from a single compound. It is usual for this factor to be determined by trial and error from a starting point of the most difficult component to be formed.

The cold-applied compounds are less easily defined chemically, but generally the dried films are physically similar. This type of product usually contains vegetable soaps with free vegetable fatty acids in water with a water-soluble solvent. This tends to make the product expensive and it is only in rare instances that any advantage can be offered over the hot-applied compounds.

Application Techniques

Cleaning

In the majority of instances an instrinsic feature of the dry lubrication process is the inclusion of a cleaning operation prior to lubrication. The purpose of this operation is to remove from the sheet all solid abrasive dust and metal particles which may be embedded in the protective oil layer and removal of oils and greases. The ideal standard of cleaning is a completely "water-wettable" surface so as to obtain high adherence of the lubricant film. A well-cleaned and rinsed surface will permit chemical reaction with the lubricant and a boundary formation of iron (or other basis metal) soap. Bowden and Tabor[1] have shown that there is a relative weakening in attachment and decrease in breakdown temperature of the metallic soap layer in the presence of excess paraffin oil. Adequate cleaning and rinsing are, therefore, vital to successful operation of the process and inefficiency in these stages can lead to a number of troubles. If protective oil is retained on the sheet, contamination of the lubricant solution will occur and produce ineffective lubricating films and will interfere with accurate chemical control. Contamination of the lubricant solution with oils and greases as a result of poor cleaning tends to give more trouble than contamination with alkali resulting

from inefficient rinsing. The film characteristics produced from the majority of solutions do not alter radically over a *p*H range from 8 to 12 and mild alkaline contamination can therefore be tolerated. There is, however, the medical opinion that an increase in *p*H of the film above about *p*H 8.0 will tend to increase the likelihood of harmful effects on the skin in the event of prolonged contact.

While the majority of lubricating solutions contain incorporated surface-active agents capable of dealing with mild oil contamination, the effect of gross contamination is to prolong drying times and cause uneven film coatings, liable to lead to lubricant build up in the press tools. A defect arising from ineffective cleaning and rinsing is the production of a coating of extremely low film strength with poor adhesion and low lubricity value. A typical pattern explaining this would be that a layer of protective oil remains attached to the sheet which is coupled with a soft soap and free alkali from the spent cleaning solution. The lubricant film when applied over these layers can be dried but the overall "sandwich" coating of oil, soft soap, alkali and lubricant film is of excessive thickness with a resultant loss in polar bond between the lubricant film and basis metal. Also, the physical advantages of the normal lubricant film associated with its crystalline structure are lost due to the hydrodynamic properties of the underlying oil and soft soap layers.

Lubricant Application

There are basically two commonly used systems for applying lubricants, each being applicable to either the hot- or cold-applied compounds. These consist of either application by immersion in the lubricant solution or conveyorizing through an application chamber where the lubricant is applied by spray or roller coater. In some instances when hot-applied compounds are in use, auxiliary drying equipment is unnecessary, but it is more usual for this to be incorporated in the application plant so as to create greater flexibility of capacity and to save time. The process consists, therefore, simply of cleaning, rinsing, lubricant application and drying.

Immersion Method

The general plant requirement for immersion application consists of a line of tanks, an overhead runway with trolley, a variable speed hoist and a series of jigs, racks or baskets to contain the sheet. The operation of the plant is in principle extremely simple, but the employment of a little practically proven technique can make a great difference to process cost and performance results.

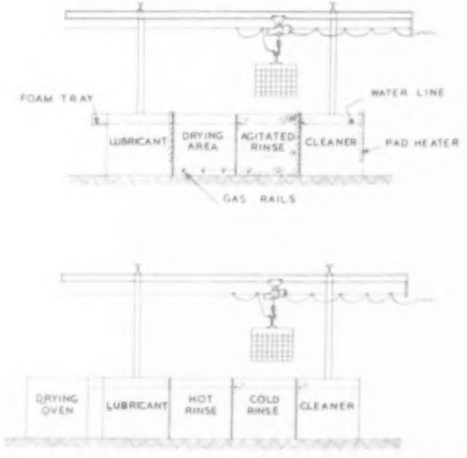
A commonly used line consists of only three mild-steel tanks, a heated cleaning tank, a cold, running-water rinse, and a heated tank for the lubricant solution. Lagging of the heated tanks is worthwhile because economic loading of the plant invariably requires a relatively high surface-area to tank-volume ratio. In the lay-out shown in Fig. 1a the heat losses from the heated tank are utilized to assist drying which may be useful if lagging is dispensed with. The heat in the drying area may also be supplemented with a gas burner but a disadvantage of this lay-out is that work passing over the drying area will tend to drip on to work being dried. When facilities permit, an ideal lay-out (shown in Fig. 1b) would therefore consist of:—

(i) Clean
(ii) Cold rinse
(iii) Hot rinse
(iv) Lubricate
(v) Dry.

The insertion of the hot rinse involves an additional operation, but this tends to decrease cycle time by reducing immersion time in the lubricant solution. This, of course, will not apply to the cold lubricant solutions, but when it is considered that as a medium of heat transfer to a metal sheet, immersion in a heated solution is far more economical and efficient than placing in an heated atmosphere, the limited use of cold lubricants in immersion systems is explained.

Due to the appreciable practical importance of the cleaning process and the fact that it is almost always this sequence which governs the lubrication time cycle, a little consideration is amply repaid. Standardized cleaning is more nearly attainable if the protective oils, greases and soils are standardized in type and quantity. This statement may appear ridiculous, but some effort should be made towards achieving this well near impossible objective so that the application plant can function as a con-

Fig. 1 (a) (top) and Fig. 1 (b) (bottom).—Typical layouts of tanks for immersion application of lubricant



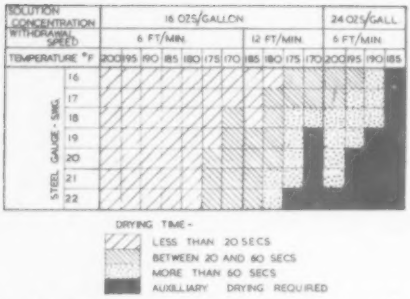


Fig. 2.—Typical drying conditions of lubricant applied by immersion

tinuous production unit on a standard time basis. An effective heavy-duty chemical cleaner is required and often, the assistance of mechanical or compressed-air agitation is beneficial and time saving, while operating at a rolling boil provides additional agitation and more rapid detergent action.

The tank should be designed with side heating opposite to a weir overflow so that floated oils can be convected to waste and peptized oil sediment can sink to the tank bottom and remain undisturbed. A false tank bottom will obviate any premature dumping of the cleaner rendered necessary by sediment circulating and adhering to otherwise cleaned sheets. An average cleaning time will be in the order of five minutes although this and chemical consumption cost will vary according to the type and quantity of soil present on the sheets.

Agitation of the running-water rinse is also an advantage and aeration is preferable. The rinse tank should also contain a weir overflow with an outlet compartment large enough to drain off in a few seconds all of the water displaced by work placed into the tank. This will ensure that floating oil carried into the rinse will disperse from the surface during the rinsing period. The simplest means of obtaining a positive "skimming" action on the water surface is to have a water inlet through a horizontal perforated pipe just above the water surface opposite the weir overflow. Similar water inlets below the water surface will usually provide sufficient aeration for adequate rinsing.

It is not always appreciated that in an alkaline cleaning operation, the water rinse is a vitally integral part of degreasing and for this reason a reasonable water exchange rate is needed. Generally speaking, if the *p*H of the rinse is maintained below *p*H 9.0, cleaning is adequate and contamination of the lubricant is avoided.

The lubricant tank should be side or end heated with a small tray opposite the heated side. This arrangement permits the full nominal volume of solution to be utilized as a basket of maximum size can be withdrawn from the lubricant solution without picking up foam or scum from the solution

Fig. 3 (a) (above).—Typical pick-up of foam and scum from heated lubricant solution

Fig. 3 (b) (below).—Typical "striped" coating from heated lubricant solution

surface. Surface foam and scum formation is an inherent feature of such solutions due to the sudden temperature drop at the solution air surface, where a supercooled soap skin is formed. If the heating unit is of the flat plate type this will ensure that even at different solution levels, heat convection will break up the soap skin and skim it into the side tray. Picking up scum and foam from this solution will cause uneven coating of sheets (as shown in Fig. 3a) and in some critical instances (*e.g.* thin-gauge polished stainless steel) even small "runs" of lubricant or the least trace of uneven coating will involve rectification of the pressing. In these cases an additional safeguard is to load the sheets longitudinally at a right-angle to the convection current. It is then only the unimportant edges of the sheet which are likely to pick up foam or scum on withdrawal from the solution. With the higher operating temperatures giving vigorous skimming action, foam is more likely to occur than scum and this is usually less troublesome, as only rarely is an uneven film of any consequence likely to result from foam pick-up.

There are several variable factors affecting the quantity and quality of the lubricating film in an immersion application but the following generalizations are applicable for the different types of proprietary compounds. Within the specified operating conditions for a given solution, film thickness can be increased by:—

(*a*) increasing solution concentration;
(*b*) reducing operating temperature;
(*c*) increasing withdrawal speed; and
(*d*) reducing immersion time.

The gauge of the sheet being processed is a further relevant variable. It will be seen, therefore, that in application of the film by immersion, it is the speed of drying which governs film thickness and evenness of distribution. At slow withdrawal speeds, provided immersion time is sufficient for the sheet to attain solution temperature, drying of heavy-gauge sheets is instantaneous on withdrawal and a perfectly homogeneous film is obtained. In addition, under these conditions the surface tension condition between the sheet and solution prevents foam and soap skin adhering to the sheet and drying to form protruberances. A typical example of instantaneous drying would be 20-gauge steel, withdrawn at 6 feet per minute after one minute immersion, in a solution at 200° F. containing 16 ounces per gallon of compound. The table in Fig. 2 shows drying conditions experienced with mild steel 6 in. × 12 in. after a one minute immersion in a typical proprietary compound solution. Generaly speaking drying within 20 seconds will give an even film of highest standard, but any sheet capable of being dried by its own retained heat is adequate for most purposes. However, where instantaneous drying does not prevail, in the case of high standard components, precautions must be taken against thicker streaky "runs" of lubricant being dried on the sheet. Also where a relatively fast withdrawal of light gauge sheet is made from the solution, a "striped" film coating will result (as shown in Fig. 3b). This effect is caused by the semi-dried lubricant flowing down the sheet in layers before finally drying. This occurrence is not generally troublesome under the press, as under pressure the high-spots tend to diffuse into metal pores, but is more pronounced on light gauge polished sheets having diminished surface porosity (*e.g.* polished stainless steel). These "stripes" are clearly visible on the formed component particularly where the surface had been subjected to pressure only, rather than extension or extrusion, where some ironing out of the "stripes" occurs.

The "striped" effect can appear to be quite disconcerting but in fact the indentations in the metal are only a matter of micro-inches in depth. However, if the component is to receive no final polishing operation, the defect must be avoided by operating at maximum solution temperature and minimum withdrawal rate.

The avoidance of streaky lubricant "runs" even where supplementary drying is required, can usually be achieved with correct carrier design. Ideally, sheets must be racked separately and it is usual for sheets to be a minimum of about $\frac{3}{8}$ in. apart. Where separators are used they should be of round rod or wire to give minimum contact with sheets and a vertical location is usually more satisfactory. Where large flexible sheets are being processed sufficient separation should be given to prevent sheets touching. Carrier design will depend largely on the shape and size range of sheets to be processed, but more often than not some degree of interchangeability is necessary. This can often be achieved by having "Y"-shaped separators which can be pegged into holes as required. The basket should be designed so as to minimise chemical contamination of solutions and for rapid and easy loading and unloading of sheets. Handling of sheets can comprise 85 per cent of the cost of operating an immersion lubricating plant so that the matter of basket design is one of major importance.

For the great majority of applications, the process is quite tolerant to abuse, a wide range of operating conditions are permissible and completely unskilled labour can be utilized. It should be mentioned that as some steam is evolved in the operations, where plant is sited in confined space, exhaustion may be desirable. A typical immersion plant is shown in Fig. 4.

Automatic Application

Automatic application of dry-film lubricants will naturally require considerably greater capital outlay than a manually operated immersion plant. A

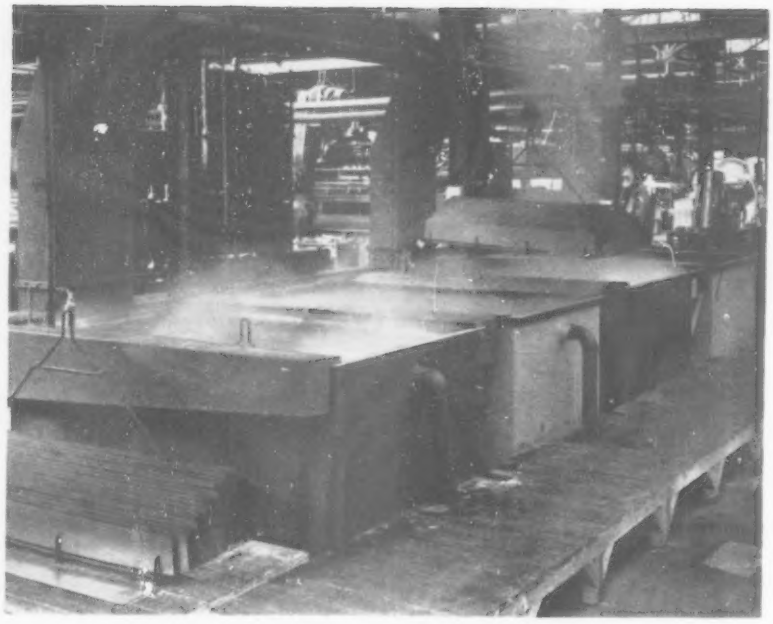
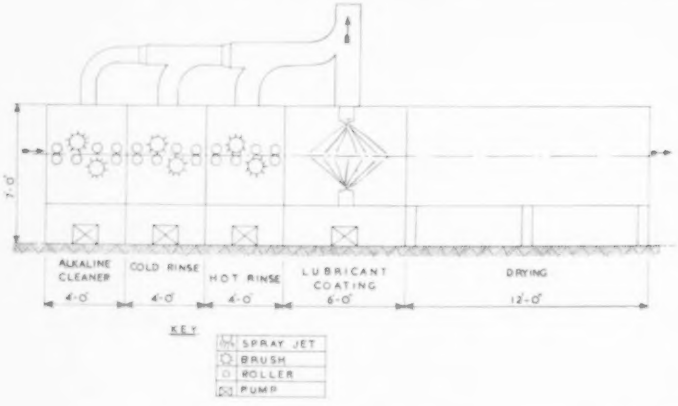


Fig. 4 (right).—Typical plant for heated application of dry drawing lubricant by immersion

(Courtesy of Revo Ltd.)

Fig. 5 (below).—Diagram of typical scheme for automatic application of drawing lubricants



compromise with the standard practice in the U.S.A. of a conveyor line can be effected by automating the immersion system, but this will still rely upon manual loading and unloading of sheets. Although manual loading and unloading may be done on a conveyorized system, it is now becoming more usual for unstacking and feeding equipment to be employed. Also by utilizing mechanical handling equipment coiled strip can be processed through the conveyorized system.

A "straight-through" system is most commonly used and sheets or coil are carried through the machine horizontally. Fig. 5 shows diagrammatically the typical essentials in an automatic lubricant applicator, and Fig. 6 shows a plant in operation. The sheet is fed through the cleaning and rinsing section between pinch rollers and at least one set of rotary nylon bristle brushes are included at each process station. Cleaning solution and rinse water is jetted down on to the brushes so that positive cleaning action is provided by brushing, power-jet and chemical action. Solution is channelled back to the storage tanks below the conveyor line where it is recirculated by pump. Counter-flow of solutions from one tank to the next is achieved by a compartment wall beneath the conveyor and a positive pressure from the brush on to the passing sheet.

The construction of the lubricating chamber will depend to some extent upon the method of application. The two methods at present employed are atomized spray or roller coating. Either method can be used for the hot or cold applied compounds, but inevitably roller coating is limited to flat sheet.

For spray application standard paint-type guns are used and either steam or compressed air for atomization. These are mounted in batteries above and below the conveyor on swinging arms so that individual guns can be cut out and the spray arc

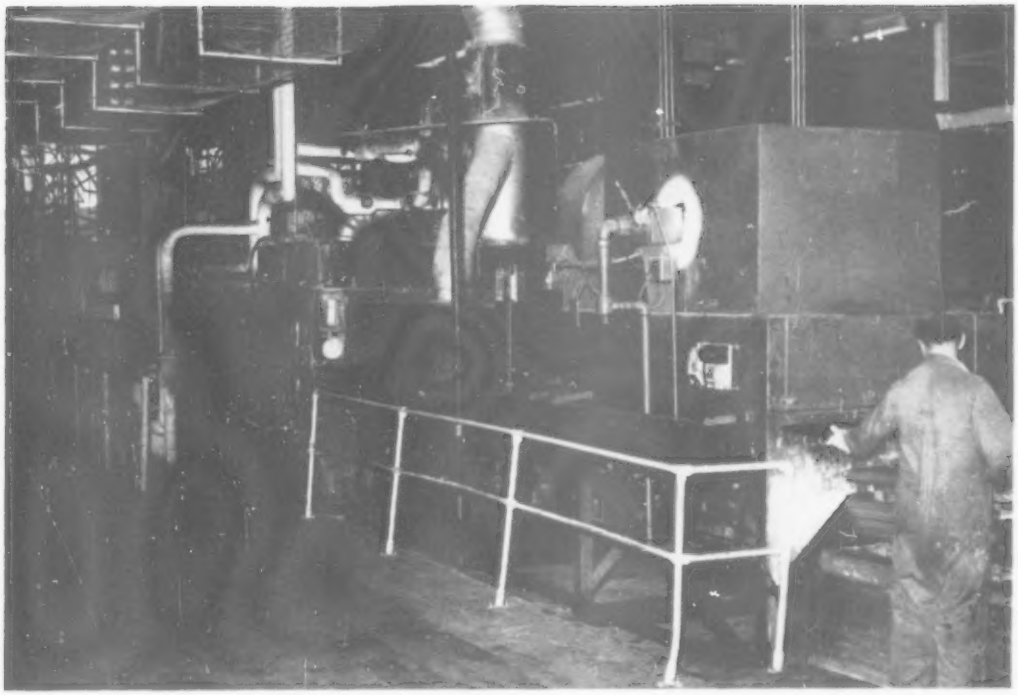


Fig. 6.—Showing delivery of coated sheets from conveyorized lubricant applicator (Courtesy of Hoover (Washing Machines) Ltd.)

adjusted as required. In this way selective lubrication of the sheet can be obtained. In the circulation system facilities are incorporated so as to control air/steam pressure, solution flow-rate and nozzle orifice so that a wide degree of flexibility and control of film thickness is achieved. The spray method of application is the only practical means of re-applying lubricant to part formed components which is normally only necessary after annealing. On the type of component within the working limitations of dry film lubricants such eventualities are rare, but modification of the applicator will be required if provision has to be made. In this case the roller feed would be replaced by an endless mesh conveyor system and cleaning and rinsing carried out by power-jet. As an alternative, the lubricant can be manually sprayed on to partially cooled components immediately following the annealing operation.

Roller-coat application is used to a great extent with the cold-applied compounds because the "gelling" temperature of some of the hot-applied compounds tends to lie within critically narrow limits and the feed of cold solutions to the rollers is more readily controlled. Generally speaking roller applications are less used than spray methods due to operational difficulties in obtaining standard results over a wide range. Roller coating units are available which do not normally cater for precleaning of sheet but include drying arrangements. These are manufactured primarily for the drying of oil- and wax-type films but can in some instances be adapted for use with the water-soluble dry-film lubricants. An example of this is where stainless steel is in use as is quite common for this material to be supplied in the oil-free condition where no pre-cleaning is necessary. A typical unit of this type is shown in Fig. 7.

After the lubricant application, or after the rinsing operation in the case of spray-application, it is usual for conveyance of sheets through the machine to be on knife-edged rollers set obliquely to the shaft and staggered. This will prevent undue damage to the lubricant film before drying is complete. The drying chamber is a simple gas-fired oven achieving an atmosphere temperature between 200 and 300° F. or infra-red banks can be used.

Automatic machines for dry-film lubricant application tend to be purpose-built but the simplified principles described cover the types in present use. Naturally before installation of such equipment proceeds, investigations have to be made into long-term production requirements so that design is adequate for future needs. For example, the minimum blank size which can be coated is

fixed by the distance between feed rollers, while the capacity of the machine is dependant on the correlation between thermal efficiency, conveyor speed and drying space.

An average conveyor speed is in the order of 60 ft. per minute and in many instances an increase above this tends to increase floor space requirements for the drying section excessively. However, with good thermal insulation on the cleaning and rinsing section, especially if a hot rinse is incorporated, the sheets are to some extent pre-heated prior to lubrication. If a warm air blast is directed on to the sheets prior to entry into the application chamber they are at this stage hot and dry, thereby conserving later drying requirements.

Floor space requirements will, of course, depend upon capacity, but as a general guide the lay-out shown in the diagram (Fig. 5) would relate to a conveyor speed of about 40 ft. per minute while total height would depend upon convenient situation of exhaust ducting. As a general rule total width tends to be at least twice that of the maximum width blank to be processed. Such matters, are of course, subject to the ingenuity of individual design but these remarks apply to machines current in the U.S.A. which have been copied to a great extent in the U.K.

The siting of an automatic applicator will need to be conveniently near adequate drainage and water services with sufficient three phase current to operate circulating pumps, conveyor drive motors, extractor fans and the like. If electricity is not the selected means of heating, gas will be required for the oven and heating of solutions, unless steam or high-pressure hot water are preferred for the solutions.

Process Control

Control of cleaning solutions, rinses and lubricant solutions under reasonable operating conditions are very simple and can usually be performed at workshop level. As a matter of routine stringent control does not prove necessary as when the process has become established, rates of chemical replenishment and dumping are known and can be scheduled. It is in the early stages of operation that tight control is advisable so that any sources of contamination which exist can be eradicated thus enabling the control to be carried out by simple chemical tests. It is usual for the suppliers of proprietary cleaning and lubricating compounds to specify chemical control methods for their products. For cleaners these usually consist of titration with a standard acid solution so that concentration of alkali is determined.

Unfortunately this does not take into account the degree of soil saturation and here it is necessary to establish with a given cleaner the break-even point where regeneration by replenishment becomes uneconomical. This is best done by maintaining the cleaner at a given concentration and observing the point at which cleaning becomes ineffective. If possible this should be related to a work throughput quantity and with a suitable safety margin, the dumping requirement is known. Control then consists of a periodic simple titration and observation by the operator.

The rinses can be checked periodically with *p*H indicator papers to ensure that water exchange is sufficient to avoid lubricant contamination. If this can be relied upon, the hot-applied lubricants can be controlled by acid titration. An additional check can be applied by a fatty solids estimation which is also a useful means of controlling concentration of cold lubricants. This method consists usually of splitting the soap with acid and reading off the separated fat as a direct volumetric percentage against graduations marked on the containing flask. It is usual to express results in ounces per gallon of compound but slight variations between apparently

Fig. 7.—Automatic lubricant coating and drying unit
(Courtesy of Automation Ltd.)

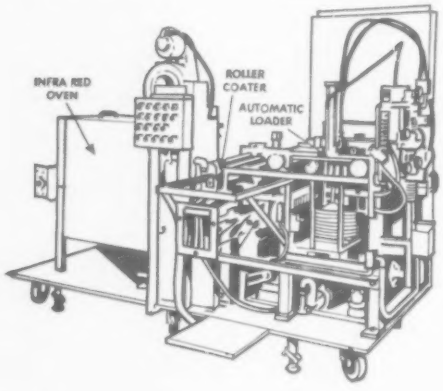
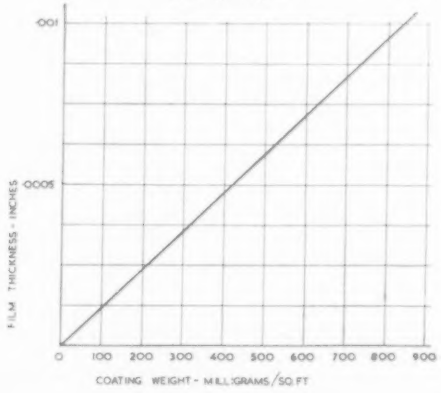


Fig. 8.—Typical relationship between film thickness and coating weight



similar proprietary compounds may be explained by different degrees of hydration in the alkaline crystal contained in the compound as supplied.

Inspection of the quality of lubricant film relies upon establishing some sort of standard based upon the minimum performance requirements of subsequent production operations. In practice this is quickly done soon after introducing the process, if necessary by applying a principle of trial and error. With automatic application constant high quality of film is assured and with immersion plants the matter usually resolves itself into a little extra care being required for certain components, as in the great majority of instances a perfectly even film is not vital.

Again, it is only in a few instances where film thicknesses are critical, but naturally it is more economical to use as thin a film as permissible. Considerations affecting this issue are, the severity of the deformations involved, the number of forming operations involved and subsequent fabrication and finishing processes.

It is best for optimum film thicknesses to be established by experimentation on the specific components envisaged. Reproduction of desired results is then achieved by specifying conditions of application as follows:—

(i) Type of compound
(ii) Operating temperature
(iii) Solution concentration,

and in an immersion plant—

(*a*) Time of immersion
(*b*) Speed of withdrawal,

or in a spray application—

(1) Conveyor speed, air/steam pressure, solution flow-rate and nozzle setting.

If recording of thicknesses is required, this can be expressed in weight per unit area by processing a test-piece. This is then weighed and the film stripped in hot water and the test-piece re-weighed after drying. As some films tend to be hygroscopic, it is best to standardize on dessication and time delay before weighing to ensure accurate comparisons. Fig. 8 shows a typical relationship between coating weight and film thickness of a hot-applied compound. This relationship was determined by measuring a magnified projected image of coloured films of known weight, but it is not suggested that this procedure is necessary for practical methods of control.

Compatibility of Dry-film Lubricants with Certain Metals

Very largely the useful application of water-soluble dry-film lubricants is confined to steel. Successful use on other metals is possible but not widespread. It is difficult to generalize about reasons for this, but with the more re-active metals, due to the slightly alkaline properties of the lubricant a reaction occurs causing an etching of the surface on such metals as aluminium, zinc, brass and tin. Also, on storage of lubricated sheets of these metals, hydrolysis occurs resulting to a greater or lesser extent in the formation of amphoteric salts of the metal with dehydration of the lubricant film and eventually an appreciable conversion of sodium soap to that of the basis metal. While the extent of these chemical reactions will depend on the formulation of the compound used, these factors do limit the usage on some non-ferrous metal surfaces. Also practical experience has shown that in many applications involving the softer metals, the heat generated by metal deformation is insufficient at pressure contact points to induce fluidity in the dry-lubricant film. This state of affairs coupled with chemical reaction between metal and film therefore does not result in adequate lubrication for some non-ferrous requirements. These views are borne out by the fact that with the more severe extrusions of aluminium for example, using a thick lubricant film, wall area reductions of 40 per cent can be achieved with adequate lubrication.

Dry-film lubrication of stabilized steels presents no problem, but with grades of steel subject to ageing, problems may occur due to exposure of the steel to higher temperatures. The extent of the problem technically will depend on the nature of the component to be produced and the grade of steel otherwise suitable for the job. However, the commercial aspect cannot be overlooked, which is that in the event of steel stock being subjected to temperatures higher than normal ambient, responsibility for any failure in performance is completely disclaimed by suppliers. The rate of strain-ageing has been investigated by Hundy[2] and it is from Hundy's Formula,

$$\log_{10}\frac{t_r}{t} = 4000\left(\frac{1}{T_r} - \frac{1}{T}\right) - \log_{10}\frac{T}{T_r}$$

where t_r is the ageing time at room temperature T_r and t is the ageing time at an elevated temperature T the temperature being expressed in °K, that the graphs shown in Figs. 9a and 9b are derived. The time index is based on the commercially established criterion that age-hardening steel must be used within six weeks of receipt, and the graph therefore, assumes a general ageing time of six weeks at 15° C. Figure 9a aims at showing a simple overall picture of the relationship between ageing time and temperature and Figure 9b is a magnified section of this curve in the temperature range more relevant to lubricant application conditions. It will be readily seen that the time margin available before the steel is fully age-hardened is vastly reduced in the temperature range of lubricant application. However, the time limit available may be greater than at first appears because during the processing operation, the time of exposure to increased

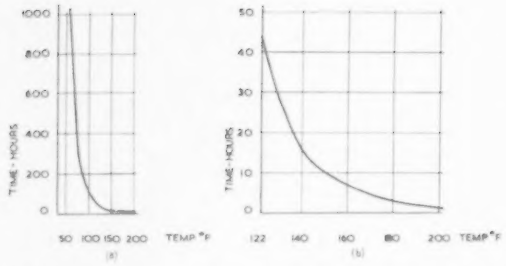


Fig. 9.—Relationship between strain-ageing time and temperature

temperature is considerably shorter than maximum ageing time. In an automatic process the sheet is exposed to 200 °F. for about 30 seconds and in an immersion application for about 8 minutes. Cooling time must also be taken into account and the safety margin will be maximized in the case of large light gauge sheets stacked in small piles. It is, therefore, impossible to evaluate this factor accurately without carrying out tests under specific operating conditions relating to specific sheet sizes.

Users of rimming steel do find that satisfactory components can be formed even from age-hardened steel, either because the deformation is not very severe or because surface condition of the pressing is unimportant. In marginal cases with wet lubrication, it sometimes occurs that dry film lubricants give consistently satisfactory results. In critical instances, where it is desired to use dry lubrication, some remedial measures are needed. This may include using blanks almost immediately they are lubricated, which is not always convenient. An alternative if blanks are stored after lubrication, is a roller-levelling operation which does not interfere with the lubricant film. Practice and effectiveness will naturally depend on circumstances but Anthony[3] mentions the practice of an American appliance manufacturer to roller level dry-film-coated sheets not more than four hours before fabricating on the presses.

The hot-applied films can be effectively used in conjunction with phosphate coatings. They do not completely cover the range of usage associated with the conventional phosphate/soap systems which usually contain a high proportion of free fatty acids, rendering the dried film water insoluble. This is because the water-soluble film is thinner and must, therefore, be used in conjunction with a refined phosphate coating in order to ensure that the phosphate crystal does not protrude beyond the lubricant film. This system would, therefore, fall about mid-way in the range of phosphate/soap lubrication but can be particularly useful where high grade finishes are required or when easy removal of lubricant is required prior to painting. In some instances where phosphating has been an established practice it has been possible to satisfactorily substitute dry film lubrication alone, but in these cases, it was not established that phosphating was vital and it is possible that a good wet lubricant could have been similarly substituted.

Comparison of Water-soluble Dry-film Lubricants with Conventional Lubricants

The desirable properties of drawing lubricants extend beyond the requirements of the actual drawing operation where it is necessary to reduce friction by separating moving metal surfaces at often high contact temperatures. Experience shows that what is a good lubricant in one situation, can be completely unsatisfactory in another similar situation, for reasons other than press performance.

It is proposed, therefore, by means of results from a few simple practical tests, to illustrate some comparisons between the dry film and conventional lubricants. This task is extremely difficult because of ethical considerations, and the vast number of mediums included in "conventional" lubrication. A convenient compromise was to use the range of one manufacturer comprising an oil, a pigmented paste, hot-applied dry-film lubricants and a cold-applied dry-film lubricant. The oil is supplied as a concentrate and a 25 per cent dilution in paraffin is the standard recommendation while the paste is recommended at 25 per cent in water. These recommendations were followed and application was by roller coater giving a standardized lubricant thickness conforming to workshop conditions. In all cases, protective oil was removed from steel before applying lubricants and the dry lubricants were applied by immersion under conditions conforming to standard practice. Two hot-applied compounds were used for some of the tests to illustrate different properties which are evident from the relevant results.

Comparison of Dryness

In this test, a dry degreased sheet and a sheet with normal protective oil was included for additional comparison.

The test consisted of measuring the retention of—

(*a*) dust of 100 to 200 mesh, and

(*b*) iron filings of 30 to 60 mesh particle size upon coated sheets.

In each case, the dust was applied under saturation conditions of $\frac{1}{4}$ in. depth where it was impossible for all particles to be retained and also under unsaturated conditions of 0.5 gm. to 1 sq. in. where complete retention of particles was possible. The coated sheets were then rotated slowly through 180 deg. and after 10 seconds the particles retained were weighed. (Table I).

Lubricant Removal Comparisons

This test measured the weight of lubricant removed from standard coated sheets by normal

TABLE I

	30- 60 mesh Iron filings		100-200 mesh Dust	
	Saturated	Unsaturated	Saturated	Unsaturated
	Per cent particles retained, gm. per sq. in.	Per cent of 0.5 gm. retained on one sq. in.	Per cent Particles retained, gm. per sq. in.	Per cent of 0.5 gm. retained on one sq. in.
Dry degreased sheet	Nil	Nil	Nil	Nil
Protective oil	0.234	46.3	0.0967	20.5
Drawing oil	0.189	25.0	0.128	27.6
Drawing paste	0.0049	12.6	0.0861	21.6
Cold-applied dry lubricant	Nil	0.3	0.0007	0.04
Hot-applied dry lubricant A	0.0014	0.06	Nil	Nil
Hot-applied dry lubricant B	Nil	Nil	Nil	Nil

industrial methods. Results indicate percentage of lubricant removed after 5 minutes immersion in each solvent and in the case of grease burning this was done at 400° C. (Table II).

Welding Requirement Comparisons

For this test, two coated strips were spot welded together and tensile tested after seven days. Welding electrodes were thoroughly cleaned in each instance and electrode areas, distances and pressures were identically pre-set for the welding operation. The tensile test was not taken to final breaking point and the extension load was measured at that point where first failure of weld occurred. Examination of the "tear" produced, showed that the area of the rupture was the same in all cases. Results obtained are shown in Table III.

Corrosion Tests

The results of the tests are shown graphically in Figure 10. It must be pointed out that the tests favour the dry lubricants to the extent that these have virtually no corrosion resistance when exposed directly to atmospheric conditions, their water solubility rendering them grossly inferior to the conventional lubricants in this respect. The test pieces were twelve square inches in area and were degreased so that the corrosion resistance of the lubricant film only was compared. The conventional lubricants would, of course usually be applied over a protective oil and thus achieve additional corrosion resistance.

Static Friction Comparisons

These tests were carried out with a conventional inclined plane consisting of bright annealed temper-rolled, deep-drawing steel and a slider of polished tool steel. The tests were performed with slider loads of 250 gms. and 2,000 grams respectively, in one instance with a clean, grease-free slider, and in the other with the slider similarly coated with the lubricant being tested. (Table IV).

Erichsen Test Comparisons

A standard Erichsen test was carried out on lubricated M.S. strip from the same sheet of exact thickness 0.067 inches and cup depth and drawing force recorded are shown in Table V.

Comparison of Press Performance of Dry Film Lubricant

It is proposed to deal with this most important aspect in very general and empirical terms. Under industrial production conditions, the manufacture

TABLE II

Lubricant	Cold water	Boiling water	Sodium orthosilicate (concentration 8 oz. per gal. at 200° F.)	Trichlor-ethylene vapour	Grease burning and pickle in 50 per cent hydrochloric acid
	Per cent	Per cent	Per cent	Per cent	Per cent
Drawing oil	14	37	100	100	100
Drawing paste	27	36	100	100*	100
Cold-applied dry lubricant A	100	100	100	100	100
Hot-applied dry lubricant A	100	100	100	18	100
Hot-applied dry lubricant B	100	100	100	23	100

* N.B.—Practical observation has shown that in this case, the result is valid for flat sheet as the powdered filler from the drawing paste is washed off by condensed trichlorethylene. This would not be so where horizontal crevices existed, where some powder would remain.

TABLE III

Dry degreased steel	580 lb. breaking load
Drawing oil	550 lb. ,, ,,
Drawing paste	560 lb. ,, ,,
Hot-applied dry lubricant A	620 lb. ,, ,,

of optically similar components can be achieved by manipulation of several variables present in the basic process. Drawing speed, blank size and thickness, and material specification are often decided by economic considerations but some latitude may be possible. Development of a pressed component usually involves modification of tool design and blank shape until component design is satisfied. With a comparatively simple component, the tool trials necessary are not very extensive, and the lubrication factor tends to become ignored. As component designs become more complex, lubrication becomes a more important consideration, but it is still often possible to overcome lubricant deficiences by adjusting tool clearance, blankholding clearance, blank contour and other relevant variables until design requirement is fulfilled. Where production of the component requires metal deformation very near to the physical limit is the usual point where lubrication enters for consideration as a separate variable. Performance of any drawing lubricant is, therefore, most critical under these specific circumstances. Generally speaking, it does not always follow that a satisfactory lubricant for severe deformations will give equal satisfaction for lesser deformations. From the comparative tests performed, it will be

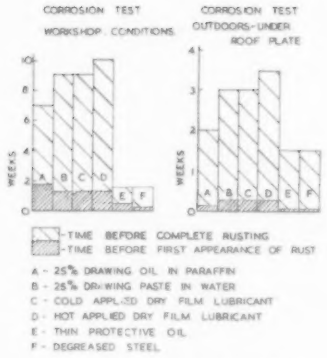

CORROSION TEST
WORKSHOP CONDITIONS
CORROSION TEST
OUTDOORS-UNDER ROOF PLATE
WEEKS
A B C D E F
TIME BEFORE COMPLETE RUSTING
TIME BEFORE FIRST APPEARANCE OF RUST
A - 25% DRAWING OIL IN PARAFFIN
B - 25% DRAWING PASTE IN WATER
C - COLD APPLIED DRY FILM LUBRICANT
D - HOT APPLIED DRY FILM LUBRICANT
E - THIN PROTECTIVE OIL
F - DEGREASED STEEL

Fig. 10.—*Corrosion-test results*

seen that frictional properties of the dry lubricants can be altered by varying the soap content but this will also change extreme pressure and temperature characteristics. Generally speaking, the hot-applied dry lubricants have lower static frictional co-efficients than the conventional wet lubricants, which assumes greater importance in relatively slight deformations. A greater blankholding pressure may be necessary than when using a wet lubricant, for this reason.

In most drawing operations, frictional resistance is due to welding occurring at contact points of the two moving metal surfaces and the primary object of the drawing lubricant is to prevent metal to metal contact. If this object is successfully achieved, frictional resistance is then due largely to the internal stresses in the lubricating barrier due to compression necessitating lateral movement of

TABLE IV

Lubricant	Clean slider		Coated slider	
	Co-efficient of friction		Co-efficient of friction	
	250 gm. load	2,000 gm. load	250 gm. load	2,000 gm. load
Drawing oil	0.28	0.25	0.20	0.21
Drawing paste	0.18	0.22	0.20	0.20
Hot-applied dried lubricant A	0,19	0.17	0.17	0.16
Hot-applied dried lubricant B	0.16	0.16	0.14	0.13
Cold-applied dried lubricant	0.30	0.30	0.49	0.50

TABLE V

Lubricant	Erichsen cup depths (mm.)	Drawing force (Kg.)	Drawing force to cup-depth ratio
Drawing paste	13.11	2,400	$10^2 \times 1.831 : 1$
	13.19	2,400	$10^2 \times 1.820 : 1$
Drawing oil	13.01	2,500	$10^2 \times 1.922 : 1$
	12.90	2,400	$10^2 \times 1.861 : 1$
Hot-applied dry lubricant A	13.20	2,300	$10^2 \times 1.742 : 1$
	13.20	2,350	$10^2 \times 1.780 : 1$

lubricant. An efficient drawing lubricant must, therefore, fill these requirements under maximum temperature and pressure intensities present in the deformation process. The mechanism of this action is basically different for oil, pastes and dry soap films, although it is common for proprietary compounds of all types to contain some reactive soap. This is to enable a boundary formation of basis metal soap of high melting point.

The hydrocarbon mineral oils generally have low internal frictional value because their long molecular chain structure and low surface activity enable the molecules to slide freely over one another. However, they rely largely on viscosity to provide an efficient separation barrier and where metal deformation is severe and heat generation considerable, the resultant decrease in viscosity may cause film breakdown. Fatty acids behave similarly but are usually more viscous and the boundary layer of basis metal soap having a higher softening point than the fatty acid, results in producing greater stability at higher temperatures. Proprietary compounds may consist of portions of fatty acids and hydrocarbons and are often chlorinated or sulphurized so that the formation of metallic chloride or sulphide films will give greater temperature breakdown points.

The compounded drawing pastes are usually emulsions of hydrocarbons with fatty acids or soaps in water. These compounds have the advantage in that where heat generation is considerable water is driven off and up to certain temperatures viscosity is maintained due to a localized decrease of water content in the emulsion. The working range of these compounds is usually extended by the addition of finely divided solid particles (*e.g.* chalk) having low shear strength. Under pressure, these particles are readily sub-divided and thus able to spread with the flow of metal. When temperature reduces viscosity of the emulsion, metallic separation is achieved by the solid particles until the stage is reached where viscosity of the fluid is too low to maintain a continuous layer of solid particles.

The lubrication mechanism of the dry lubricants (hot-applied) is probably somewhat different. Application conditions are favourable to a monomolecular soap reaction with the basis metal and when the metal is undergoing deformation, a reservoir of soap is available for reaction with the increased number of molecules disorientated at the metal lubricant interface. Initially, the lubricant barrier can therefore be regarded as having a boundary metal soap layer with polar attachment to a composite layer containing a hydrated crystalline structure. The nature of the crystalline structure will vary according to the alkali and soap ratio. The question of viscosity does not arise with a minor deformation or in the early stages of a major one as the bulk of the lubricating barrier is solid. When contact temperature is sufficient to melt the surface layer of soap a solid liquid sliding barrier exists. Under more extreme pressures and temperature conditions the crystalline structure will possess low shear strength and will therefore offer little frictional resistance while still providing adequate metal separation. At this stage a large portion of the soap may be molten and dehydration of the alkaline crystal will occur to some extent, but it is probable that integration of molten soap and alkali occurs on a more intimate scale than with the solid filler emulsions. As Boron is a common constituent of the dry-film lubricants the possibility of the formation of a "water-glass" at high temperatures is quite probable. It will be readily seen that any appreciable fluidity of the dry film lubricants will only occur during a fairly severe deformation where temperatures are high and (relatively) prolonged. The softening point of the film will vary with formulation but will always occur at a given fixed temperature. The practical effect of this characteristic is twofold. First, the viscosity of the fluid rapidly approaches zero shortly after the point of deformation when the fluid has solidified, which tends to produce flow-resistance to any adjacent part of the film still in a fluid state.

A possible explanation for the rapid solidification which is observed in practice could be that during severe deformation fresh iron molecules are constantly available to react with molten soap so that an iron soap is formed at a temperature lower than its own softening point.

A secondary effect of this characteristic is that the lubricant film tends to be retained on the component with very little transference to the tools, this being usually limited to "filling-in" of crevices and a minutely thin "glazed" film.

As a general rule therefore, the dry lubricants can be regarded as at least functionally equal to the conventional wet or semi-wet lubricants.

The Erichsen tests performed are put forward as inadequate support for this hypothesis. It may well be that the range of efficient metal separation can be extended by the use of dry lubricants and without doubt, under conditions where scoremarking can be caused by airborne particles adhering to wet lubricants, dry lubricants are advantageous. The absence of lubricant build-up in dies can also give functional advantages. A typical example of improved surface finish when using dry lubrication is shown in Fig. 11. These components were produced during a trial of dry lubricant, the lower component being the last one off a production run using wet lubricant. The top component was produced 5,000 components later with dry lubrication, from the same tools without any intermediate polishing.

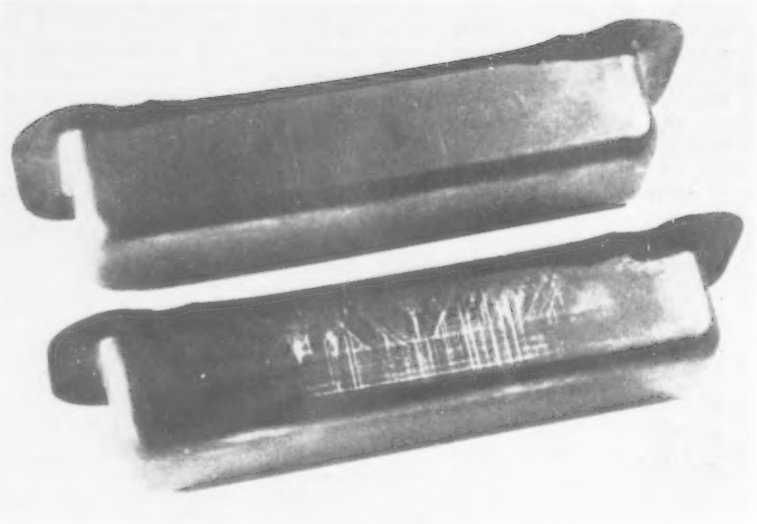


Fig. 11.—(top)—Component formed using dry lubricant.

(Bottom)—Component formed using wet lubricant with same tooling, 5,000 components earlier

Economic Aspects of Water-soluble Dry Lubricants

Lubricant performance will enter into any consideration of cost advantage offered by dry film lubrication. It must therefore be assumed that press performance of the dry lubricants has been proved equal to the system in present use before change-over will be contemplated. Full utilization of application plant will also require dry lubrication to be satisfactory for either a high volume or a wide range of production requirements.

A comprehensive economic assessment of dry lubrication is difficult because of different standards of production efficiency which occurs between different manufacturing concerns. There are also some advantages that dry systems offer over conventional lubricants which are difficult to measure in terms of cost saving. For example, the use of the dry film will to all intents and purposes, eliminate oils and greases in the press shop. The cost saving on such items as floor-cleaning and protective clothing can be readily counted but the effect of creating cleaner, more pleasant working conditions for the operative, is much less easily forecast. Dry lubrication achieves a standardization in the quantity of lubricant used on each component and this is extremely uncommon where wet lubricants are used when it is more the rule for lubricant to be applied on a more generous scale than is necessary. It is by no means unknown for lubricant material costs to be reduced by 75 per cent when dry lubricants are substituted for wet. The cost of cleaning prior to lubrication is not often the obstacle it may at first appear to be, since in most instances, this can be regarded as merely moving the bulk degreasing operation a few stages forward in the manufacturing cycle. This principle applies to all components which traditionally require a high standard of degreasing prior to finishing operations. An exception here would be where vapour degreasing is employed prior to painting, but the nature of this treatment suggests that only a low grade finish is required. In any case it is doubtful if the installation of a water-wash to remove lubricant would create any extra total cost, compared with vapour degreasing. In the case of the better quality finishes such as vitreous enamelling, pre-paint phosphating and electroplating, the pre-lubricant cleaning operation can be directly offset against the cost of cleaning normally incurred prior to these finishing treatments. When spot-welding on a pressed component is performed it is not necessary to remove the dry film before proceeding, as a sound weld can be produced without carbonizing electrodes or creating a smoke-laden atmosphere. Cost-saving on current degreasing operations can therefore be effected and also when clean-handling operations are required at such manufacturing stages as, inspection, rectification, polishing and assembly. The lower degree of scoremarking present on components can reduce polishing and paint finishing costs, while diminished pick-up on press tools will reduce tool maintenance polishing costs.

When dry lubricants are applied to sheet it is, at present, fundamental practice for this to be centralized, away from the press. The principle of central lubricant application therefore relieves the press operator of this duty and as sheets are readily separable from the pile his task is rendered much

easier. Press inactivity due to difficult blank separation and time for lubrication is therefore eliminated and idle time is restricted to blank handling time. In those cases where handling and lubrication are achieved single-handed within the time taken for the press stroke, the only advantage gained is a reduced fatigue factor and under such highly productive conditions, this may be appreciable. Where such conditions apply, a comparatively small blank size and slow punch speed are implied and no direct increase in output is expected to result from central lubrication. As blank size and or speed increase, the direct increase in press output will increase, proportionately, as idle time of the press necessary for the application of wet lubricant would also be increased if centralized lubrication were not employed. If idle time has already been reduced by having a separate operative to apply lubricant, then central lubrication eliminates the need for this operative. It is therefore possible to achieve increased press output by centralized lubrication where certain conditions prevail. Where press output is increased under manual conditions of press operation, or reduced labour content is obtained, an increase in labour productivity will also have been achieved. The context of this consideration has so far been with regard to one press but usually the principle can be extended to secondary press operations requiring relubrication when wet lubrication is used. This is because re-application of the dry film is rarely necessary and generally one lubricant application unit will supply the needs of several presses engaged on initial drawing stages.

Instances of increased press outputs of 50 per cent are by no means uncommon by the introduction of central dry lubrication and while increases above this rate do occur, this may indicate the previous employment of unusual techniques or greater than average inefficiency.

The major economic advantages of dry lubrication have been outlined together with those conditions of manufacture where those advantages are likely to be maximized. It follows that the present potential of the system lies in those fields of industrial activity where efficient standardized lubrication is essential for flow line press production of finely finished components for the consumer market. The dry system can be economically justified where it achieves a large scale reduction in unit cost by increasing output or effecting economies in ancillary processes and operations. The capital cost of application equipment can then be discounted against the cost of alternative equipment which would have been required to effect a similar increase in production.

Acknowledgements

The assistance of the following is gratefully acknowledged: Mr. J. Bowen, for assistance with photography; Mr. A. Bowkett and Mr. P. Fellows for assistance with comparison tests and to the management of R. Cruickshank Ltd., for facilities granted. Photographs of plant are shown by kind permission of Revo Ltd., Hoover Ltd. and Automation Ltd.

References

1. Bowden, F. P., and Tabor, D., "Friction and Lubrication", Methuen and Co. Ltd., London.
2. Hundy, B. B., "Accelerated Strain Ageing of Mild Steel" *Journal of the Iron and Steel Institute*. 1954, Sept.
3. Anthony, W. D. "Machine Application of Dry Drawing Compounds", Metal Products Manufacturing, December, 1957 issue. Dana Chase Publication, U.S.A.

DISCUSSION

Mr. E. W. HANCOCK (President) said reference had been made to anti-corrosion properties. Referring to motor-car production, he wondered if, for instance, in the case of a completely assembled unitary construction body, which consisted of about 350 pressings, it would be possible to add something into the mix which would extend the anti-corrosion period, so that the completely assembled body would not require any further protection. The time involved was two months.

Mr. CLARKE replied that under good atmospheric conditions, the average dry-film lubricant would be quite suitable for that time period. He wanted to make the point that the comparisons were solely between different lubricants; the protective oil had been removed from the steel test-pieces before applying the lubricant solutions. With conventional lubricants there was usually a double layer of protective oil, over which was applied an insoluble oil. When dealing with a dry-film lubricant, there was a water-soluble compound. There was no denying that there were corrosion problems, and much depended on storage conditions. So far as he knew, rust inhibitors had been added to the compound, but they had never interfered with the water solubility, which, to most people, was quite a desirable characteristic. However, the most effective rust inhibitors would interfere with the water solubility of the dry-film lubricant.

Mr. J. F. KAYSER asked about the melting point of a metal soap. He was under the impression that metallic soaps had no melting point. The author also had said that as borax was a common constituent of the dry-film lubricants, the possibility of the formation of a "water-glass" at high temperatures was quite probable. Admittedly the words "water-glass" were in inverted commas, but he thought that water glass was a sodium silicate, and it

decomposed at comparatively low temperatures. Could the author, therefore, give a detailed composition of these materials.

Mr. CLARKE replied that most of the dry-film lubricants were based on soap and borax; that would account for probably 90 per cent of the composition.

The word "water-glass" had been used very loosely; that was why it was in inverted commas. After a tool had been used on a few thousand components there was a definite glazed appearance, and as borax was present at very high contact temperatures, with possibly super-cooling conditions prevailing, he held the view that there was quite probably a boron glass formed, *i.e.* a supercooled sodium borate.

He seemed to remember having seen the melting point of an iron salt quoted as being in the region of 1,700° C. If it had no melting point, he would have thought it was even a more desirable property. The melting point of the compound as a whole was the important thing, rather than the soap addition. The melting point of the film itself could be raised appreciably by the addition of a metallic soap.

A SPEAKER asked if the author had any information on the use of this dry-film method for cold forging and how it would rate against phosphate coating.

Mr. CLARKE said that he doubted whether phosphate coating could be completely replaced. There were marginal cases, however, where the dry-film method might be equally good; the method could be used in conjunction with phosphate coatings. Quite commonly a phosphoric acid treatment which produced an ultra-lightweight iron phosphate coating of 50 milligrammes per square foot did assist in increasing the lubrication effectiveness in that range. It was usually a matter of trial and error.

Effect of Roller Levelling

Mr. D. JAMES (The Pyrene Co. Ltd.) asked the author to expand on his statement that roller levelling did not affect the lubricant film. Could he be equally emphatic that the lubricant film would not interfere with the operation of the roller leveller?

Mr. CLARKE said he would hesitate about being equally emphatic; he did not know a firm in this country which had roller levelling on production. His own experience of this was at a firm manufacturing domestic appliances where one hundred coated blanks were roller-levelled to see what the effect was. Those hundred blanks had been pressed satisfactorily. He thought it was quite a standard practice in the U.S.A., but he had no specific information.

Mr. MCKAY (National Cash Register Co. Ltd.) asked whether, by applying molybdenum disulphide to the tools, the use of these soapy compounds could be greatly reduced.

Mr. CLARKE replied that, in connexion with the dry-film lubricants, no outside or extra aid was usually necessary. It certainly was necessary to keep the tools absolutely dry and grease-free. In his experience there was no excess lubricant left on the tools or components; they were still quite dry before and after the operation.

Mr. MCKAY thought that with dry film-lubricants, the tools would tend to get clogged up.

Mr. CLARKE said if there was any water present he would agree. There was a lot of lubricant build-up which got impacted very hard. But with dry-film lubricants that condition did not apply. If there was any excess lubricant it tended to powder and to disappear.

Mr. R. PEARCE (College of Aeronautics) said that with regard to strain-ageing, Hundy's formula had been found to be incorrect; it was now accepted that rates of strain were more rapid than the formula allowed.

With regard to the assumption that users of sheet-metal tried to use their steel within six weeks of receipt, he thought this was a little bit loaded on the side of dry-film lubricants; generally speaking they tried to use material within three weeks of receipt. When using full-finish extra-deep-drawing rimming steel, the sheet steel purchaser had to decide between using stabilized steel costing £3 a ton more, or full-finish extra-deep-drawing steel which would strain-age, and would have to be used within three weeks? The author had said that users of rimming steels did find that satisfactory components could be formed even from age-hardened steel. This was true, but then the supplier was perhaps buying full-finish deep-drawing, and not full-finish extra-deep-drawing, and getting a five per cent cost saving. He thought there was a range of pressings which did not merit the £3 a ton extra for stabilized steel, but which did need full-finish extra-deep-drawing, and this special range would be adversely affected by the use of a lubricant which had to be put on at 200° F.

On the question of roller levelling, and the American experiment mentioned by a previous speaker, he agreed that the material had gone through the press shop satisfactorily, but it would be interesting to know if it had not been roller levelled, whether it would have gone through all right anyway.

With regard to molybdenum disulphide, it was well known that it stuck hard. Directly it got on to the material which was being pressed, it would adhere strongly and that would not do any subsequent painting operations much good.

Mr. CLARKE said that he was not an authority on strain-ageing, and the purpose of including that item in the paper was merely to illustrate a pitfall which people could possibly fall into unwittingly

(*Continued in page* 894)

Tool Steels for HIGH-SPEED • BLANKING and PRESSING

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(*A paper presented at the Annual Conference of the Institute of Sheet Metal Engineering, Birmingham, November 7 to 9, 1961*)

Introduction

ANY manufacturing process such as that which is the subject of this conference must depend to a large extent on both the product material and the tool material: other factors will of course contribute for example, the type of press, the product shape and the tool design. In this paper the author has attempted to discuss generally the treatment of suitable tool steels, the design of tools as related to heat-treatment, typical faults that can occur and how to avoid them. It is hoped that in the discussion that follows the presentation of this paper, specific application problems can be dealt with.

There is a wide range of tool steels available for selection, all of which will do a fair job of work with regard to blanking and pressing. In order to narrow down the field, the author is proposing that water-hardening tool steels are not really adequate for high-speed presswork and that the main attention should be drawn to the oil-quenching and air-hardening grades.

When selecting a tool steel, two main factors have to be considered; first, what is the job to be done, and second, what accuracy is demanded from the finished tool? Other aspects obviously exist, but they are not of such prime importance.

*The Soderfors Swedish Steel Co. Ltd., Lye, Nr. Stourbridge, Worcester.

The job to be done: in high-speed press work this can be blanking, piercing, drawing or forming; all operations that require individual variations in the tool steel selected.

The groups of steels which therefore lend themselves to discussion are as follows:

1. Medium-alloy steels.
2. High-alloy steels.

The groupings are not finite and there are analyses which fall between each group and which could fit into either category.

MEDIUM-ALLOY STEELS

Table I lists some of the steels which come within the required category and which form the largest bulk of usage within our terms of reference:

These types listed are variations upon a basic type that is the 1 per cent C., 1 per cent Cr., 1 per cent Mn. steel and, as mentioned earlier, are only some of the variations which exist; some showing only minor compositional deviations from the types shown.

The second group of steels which offer the best results for high-speed pressing and blanking are those referred to as high-alloy steels. Within such a grouping for our purposes must be included the high-speed steels as those are used for punches in

TABLE I

	C.	Mn.	Ni.	Cr.	Mo.	Va.	Si.	W.
	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent
Steel No. 1	0.9	1.2	—	0.5	—	0.2	0.3	0.5
2	0.9	1.0	—	0.5	—	—	—	1.0
3	0.9	1.5	—	0.5	—	—	—	—
4	1.0	0.85	—	0.75	—	—	—	0.4
5	1.0	0.4	—	1.5	—	—	0.25	—
6	0.9	0.9	—	1.15	—	—	0.3	1.5
7	0.5	0.6	—	1.4	—	—	1.0	—
8	0.9	1.85	—	0.45	—	—	0.25	0.45
9	0.7	2.0	—	1.0	1.4	—	—	—

TABLE II

	C.	Mn.	Ni.	Cr.	Mo.	Si.	Co.	W.	Va.
	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent
Steel No. 1	2.3	0.35	—	13	—	0.3	—	—	—
2	1.0	0.35	—	6.25	1.0	0.4	—	—	—
3	1.65	0.45	—	13	0.7	0.4	—	—	0.3
4	2.2	0.35	—	12	1.0	0.3	—	—	0.2
5	1.0	0.6	—	5	1.0	0.3	—	—	0.45
6	1.4	—	—	13	0.75	—	3.0	—	0.3
7	2.2	—	—	12	—	—	—	—	0.8
8	1.25	—	—	12.5	1.5	—	2.75	—	—
9	0.8	—	—	5	0.5	—	11.5	2	1.5
10	0.8	—	—	5	0.5	—	6.0	19	1.5
11	0.8	—	—	4	5.0	—	—	6.5	1.9

certain instances. Table II gives a typical selection of compositions.

The selection of a material from such lists is apt to be confusing and in the author's opinion all of them, if correctly treated and used, would do a good job of blanking or pressing in given instances. It is suggested that in certain instances variations in steel-manufacturing standards and tool-making techniques will have a much more pronounced effect than the compositional variations shown. In a paper presented to this Institute last year[1] the author discussed the variations which can occur in tool-steel quality and the need for careful selection both as regards manufacturer and grade of steel; no emphasis, therefore, is being placed upon this aspect of the subject except that to spend many skilled man-hours and money upon the manufacture of a tool without first making certain that the material is satisfactory, is not really sound economics.

The effect of each of the alloying elements present is of interest and the following points illustrate the main reason for the particular elements presence:

Carbon

The basic function of carbon in steel is to enable it to be hardened, no other element has such a powerful effect: the amount of carbon present may vary from about 0.45 per cent in plain-carbon steels to 2.3 per cent in highly-alloyed steels.

Manganese

This element serves two purposes in steel. First, it acts as a purifying agent, it helps to counter the harmful effects of sulphur and oxygen and is found up to approximately 0.4 per cent in all steels. Its second effect, when added in amounts in excess of 0.4 per cent is to increase the hardenability of a steel. For example, a 2-in. cube of steel containing 0.85 per cent carbon and say 0.25 per cent manganese, if water-quenched would fully harden to a depth of $\frac{1}{8}$ in. to $\frac{1}{4}$ in. below the surface; past that depth, the hardness would drop considerably. If to this 0.85 per cent carbon steel about 1.5 per cent manganese was added, the cube would harden all the way through. In addition the hardening would then have to take place in oil, as a risk of cracking by water-quenching would now exist.

Silicon

Like manganese, silicon is present in all steels and the general purpose is to act as a deoxidant to facilitate manufacture. Again like manganese, it is usually present in quantities up to 0.3 per cent but is also used as an alloying agent in quantities up to 2 per cent. Unlike manganese, however, silicon is not used on its own but always in conjunction with another alloying element such as manganese or molybdenum. Its main effect is to increase toughness and mechanical strength; it also somewhat improves hardenability.

Nickel

Nickel is only present in tool steels when added as an alloying element; its main functions are to increase toughness and to lower the hardening temperatures. It has a certain influence upon wear resistance but not as spectacular as does chromium. Nickel may be present from 0.5 per cent to 5 per cent. It effects an improvement in hardenability when used in conjunction with chromium.

Chromium

The main purpose of chromium is to add strength and wear resistance; it increases hardenability and unlike nickel it raises hardening temperatures. Chromium is used in amounts varying from 0.25 per cent to 14 per cent in tool steels and in the higher percentages 5 per cent upwards confers the ability to air harden. To a certain extent the greater the amount of chromium present in a tool steel the better is its corrosion resistance.

Cobalt

The prime use of this element is in cutting tools; it raises what is called red hardness and enables the cutting tool to be used at higher speeds. It reduces toughness to a certain extent but in certain of the alloys shown in Group 2 it has a different effect in that it improves the response to heat treatment by

allowing higher hardening temperatures to be used without overheating.

Tungsten

This element is added in amounts varying from 0.4 per cent in low-alloy steels to 21 per cent in high-speed cutting tools. It improves wear resistance, which is its main requirement in cold presswork tooling where the use is confined to a maximum of 5 per cent. There is a very useful range of hot work steels containing 8 to 10 per cent tungsten.

Molybdenum

This element has much in common with tungsten and chromium. It affects both the hardenability, wear resistance and the red hardness of a tool steel. It is used in conjunction with high-silicon/chromium and also replaces tungsten in certain types of high-speed steels.

Vanadium

This element is not so pronounced in its effect on some of the others referred to but, when used in small quantities, 0.1 per cent to 0.4 per cent, it acts as a grain-refining agent and improves toughness. In higher quantities its effect is to improve red-hardness. It has a side effect of improving hardenability of carbon steels in that it enables a higher hardening temperature to be used without excessive grain coarsening. Vanadium in amounts of 0.5 per cent and over usually exists for that purpose.

The materials quoted in the groups have properties which are manifested by their response to heat treatment, which ranges from oil quenching to air quenching. At this point it is of interest to consider what problems occur during the heat treatment of a tool and what can go wrong; each possible fault will be dealt with separately and the appropriate remedy suggested.

Cracking

This obviously is the most serious fault because it almost always ruins the tool completely. Cracking can occur due to the following conditions.

(*a*) *Hardening from Too High a Temperature*

Remedy.—Follow manufacturer's instructions and ensure heat-treatment furnaces are fitted with accurate temperature-recording instruments and that the thermocouples are placed near the work. It is possible in a large furnace to have a thermocouple in a corner with a temperature differential of 50° C. to the hearth of the furnace where the work is placed.

(*b*) *Allowing Work to Become too Cold After Hardening*

Remedy.—Except for highly-alloyed steels that are sub-zero treated, as a general rule always see that tools are not less than hand warm before tempering and ensure that tempering is done as soon as possible after removal from the quenching medium. If tools have to be left for a period then leave them either in a hot-air oven or in a fairly warm place.

(*c*) *Too Drastic a Quench*

Oil-quenching steels have been known to crack if oil is too cold.

Remedy.—Ensure that the quenching-bath temperature is recorded on a gauge so that the manufacturer's instructions for quenching can be followed exactly; usually the oil bath should be kept around 30° to 50° C.

(*d*) *Cracks Arising from Surface Defects in the Steels*

This type of fault can arise when tools are manufactured from too small a size of bar. All hot-rolled steel has a surface which is fissured to some extent and if this is not removed the residue of a fissure has a notch effect and gives rise to a crack.

Remedy.—Always machine an adequate amount from the surface of a bar—the following is a good general guide as to the minimum amount.

Machining allowance necessary for tool steel. By the term "machining allowance" is meant the thickness of the surface layer which must be removed from the rolled or forged steel in order to obtain the finished size of the tool being produced. The machining allowance is the addition to one side and the size of the blank should be increased by twice the machining allowance. The finished article is required to be free from surface defects and de-carburization.

In calculating the machining allowance, therefore, the following factors must be taken into account:

1. Rolling or forging tolerance.
2. Surface de-carburization.
3. Normal surface defects.
4. Degree of straightness.
5. Eccentric alignment in the lathe, etc.

Recommendations regarding machining allowance must always be approximate but it is better to allow too much than too little. For rolled and annealed bars of tool steel the minimum machining allowance can generally be calculated to the formula:

$$(a) = 0.025D + 0.025 \text{ in.}$$

where D = the diameter or thickness of the steel.

The above formula applies to round and square sizes as well as those flat sizes where the width is only slightly greater than the thickness.

For rolled flat sizes, where the width is large compared to the thickness, the working allowance of the thickness differs and mainly depends on the width. This circumstance may seem somewhat strange and can partly be explained by the fact that with flat sizes a certain amount of warping must be allowed for, which becomes more pronounced with the wider material.

For forged rounds and squares a somewhat larger machining allowance should be calculated than for rolled bars. The formula for forged bars, therefore, is:

$$(a) = 0.03D + 0.050 \text{ in.}$$

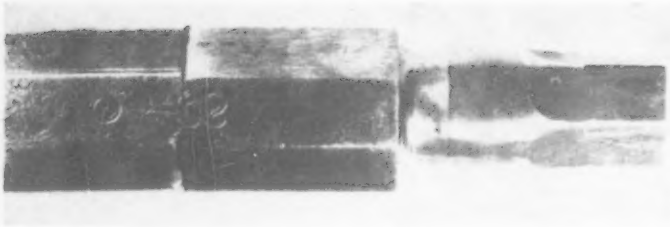


Fig. 1 (left).—Cracking due to punched letters

Fig. 2 (below).—Cracking due to hole too close to die edge

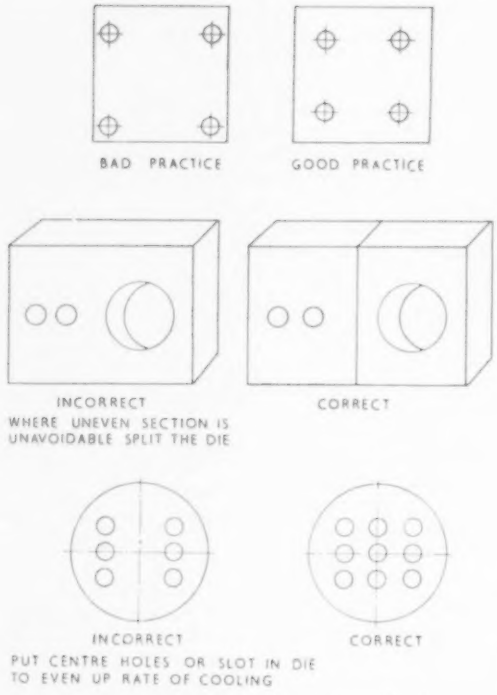


Fig. 3.—Correct and incorrect design of tools

(*f*) *Cracking Due to the Presence of Stress Raisers Placed on the Surface*

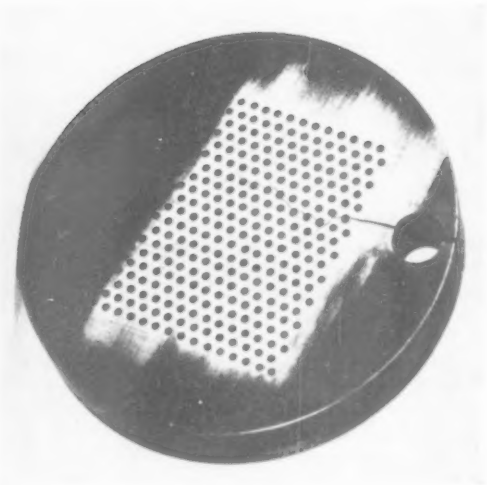
A typical example is punched letters; Fig. 1 illustrates a crack which has commenced from such a letter.

Remedy.—Use etching tools for making of tools and avoid punches. If punches are necessary, use well-radiused lettering and light impressions.

(*g*) *Cracking Due to Unsuitable Design of Tool*

The positioning of holes close to die edges can lead to cracking; Fig. 2 illustrates a die which cracked in such a manner. Fig. 3 illustrates the problem diagrammatically, with other examples.

Remedy.—Wherever possible leave an adequate thickness of metal between holes as illustrated in Fig. 3.



Soft Spots

The second defect which can be met is the production of soft spots.

(i) *Soft Spots Due to Insufficient Machining*

As referred to previously, the surface of a hot-rolled tool steel is defective and besides being fissured it can be low or completely lacking in carbon. This will result in faulty response to hardening with resultant soft spots. Fig. 4 shows an edge tool with such a carbon removal from the surface.

Remedy.—As before—adequate metal removal.

(ii) *Soft Spots Due to Insufficient Quenching*

This can be effected in two ways—first as a result of scale being present on the tool from the hardening process—if sufficiently thick, such a scale can slow down cooling sufficiently to give 58/59 Rockwell on a tool that is required to be 62/63 Rockwell C. Included in this could be soft spots caused by a decarburizing atmosphere in the furnace, producing a similar result to that shown in Fig. 4.

Remedy.—Ensure that the tools are treated in the correct atmosphere, either by using protective media such as sand, cast-iron chips, spent charcoal or salt bath, etc. Soft spots can also be caused by insufficient agitation of the cooling medium, especially where water or oil are used; if agitation is

Fig. 4 (right).—Faulty tool: soft spots

Fig. 5 (below).—Structure of annealed carbon tool steel at room temperature

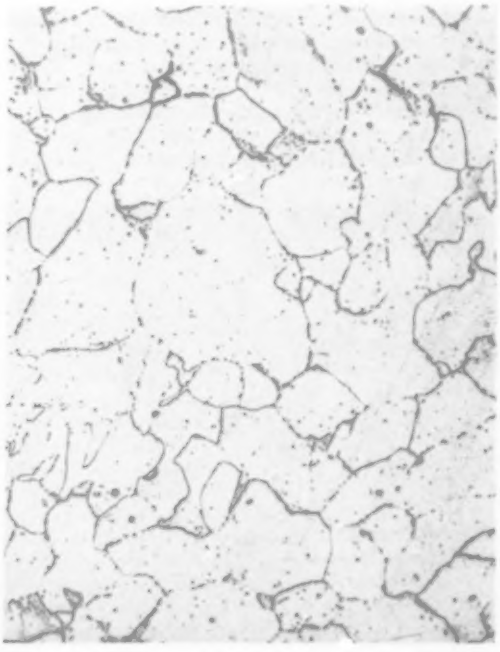
Fig. 6 (below, right).—Structure of carbon tool steel at 850° C.

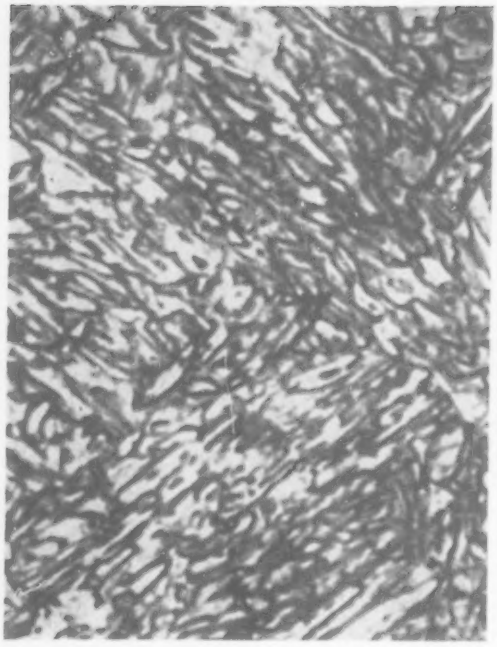
not used, vapour pockets can form against the work and so slow down the rate of cooling sufficiently to prevent full hardening.

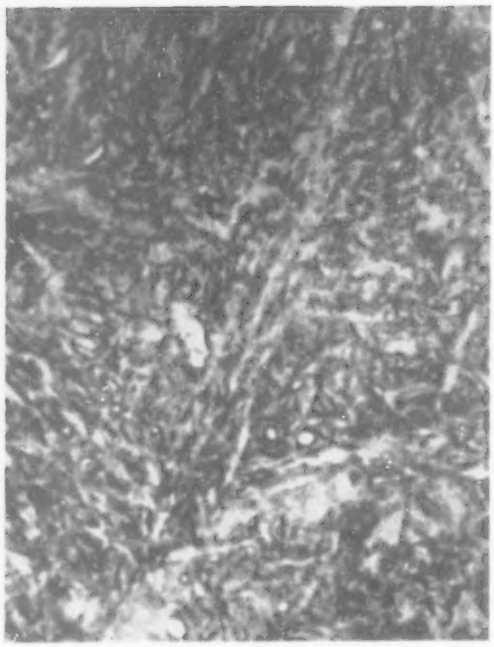
Remedy.—Adequate agitation, either of the work or the quenching media (here it should be emphasized that adequate also means, not excessive).

(iii) *Soft Spots Due to Retained Austenite*

In order to explain this problem it is necessary to describe briefly the mechanism of hardening in steel. When an annealed carbon tool steel is at room temperature, the structure is similar to that shown in Fig. 5; when the steel is heated up, the structure changes to what is known as austenite and if it were possible to examine the structure at the temperature of +850° C., it would look like that shown in Fig. 6. When the steel is quenched, the structure changes to that shown in Fig. 7 and after tempering to that shown in Fig. 8. The point in







question is that austenite is soft. With low-alloy steels and plain-carbon steels, austenite does not exist in any significant amount at room temperatures. However, the use of highly-alloyed steels can cause this austenite to become reasonably stable. For instance, in 18/8 stainless, the addition of 18 per cent chromium and 8 per cent nickel renders austenite stable at room temperatures, resulting in a soft ductile material. With steels of the second group (high-carbon chromium) it is possible to retain austenite if a carburizing atmosphere is available during heating for hardening. In the illustrated case, Fig. 9, it occurred as a result of using oily cast iron shavings for packing round the tool; it could also occur if the tools were heated in a cyanide salt bath.

Remedy.—Utilize the correct hardening conditions. If it does occur, try sub-zero treating the tool (as this subject is discussed later on, reference should be made for treatment details).

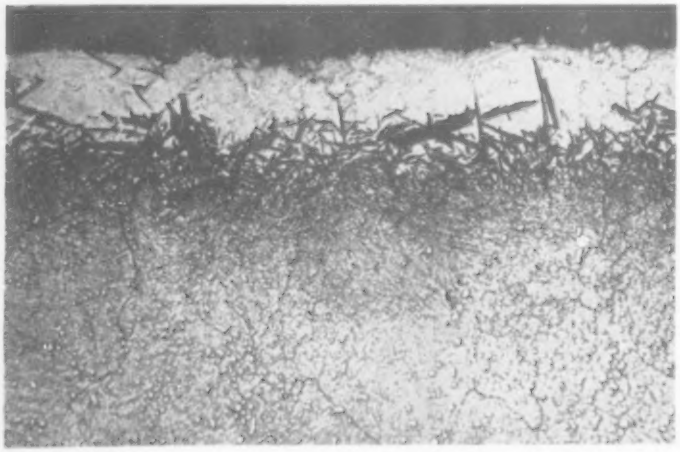


Fig. 7 (above, left).—Structure of carbon tool steel after quenching

Fig. 8 (above).—Structure of carbon tool steel after tempering

Fig. 9 (left).—Retained austenite in high-carbon chrome steel due to use of oily cast-iron shavings

(iv) *General Softness or Failure of the Tool to Give Expected Hardness*

This is not a frequent source of trouble and can be due to a number of causes, typical ones being:

1. Incorrect hardening temperature, *viz.* too low.
2. Insufficient soaking time at temperature.
4. Incorrect tempering—temperature too high.
3. Incorrect treatment for material, *i.e.* oil-quenching a water-hardening steel, or air-hardening sections too thick for adequate response and which require oil-quenching to obtain the required cooling rate.

In these cases the remedies are self-evident.

Distortion

This is a very difficult problem and one which is probably the source of greatest friction between toolmaker and tool-hardener. It requires very careful consideration and that consideration, in the author's opinion, should start with the appreciation that there is no such thing as a " non-distorting tool steel." This term originated a long time ago, when anything that did not move more than 0.015 in. per in. was considered as non-distorting. In these days of extremely accurate production and the increasing demand for tight tolerances, the author has known the term " non-distorting " to be expected to imply no movement at all on a tool which was 18 in. × 9 in. × ½ in. thick with literally a hundred or so holes in it (and which, to the author's great astonishment, came up to expectations). The point to realize is that in the thermal treatment of steel, there is a size change which takes place and that this change is inescapable; no emphasis is being made on the reasons for this change and reference to any standard work on steel heat-treatment will give the required information. The facts which require to be considered are that from a thermal aspect the perfect tool would be a sphere with a hollow interior; once a symmetrical and balanced shape is departed from, all types of stress gradients begin to occur upon quenching. The normal cycle of size change with alloy steels is for expansion and contraction to take place on the heating cycle in that order and the reverse to occur during the cooling cycle.

One of the reasons for slow and adequate preheating of a tool is not, as is often thought, to prevent cracking as such, but to prevent distortion. Consider a shape as shown in Fig. 10; if it is plunged straight into a molten salt bath when the tool is cold or just warm then due to the rate of heat input from salt, the shaded area will reach the contraction point before the unshaded area has finished expanding, so that there will be a changing stress pattern set up which could result in the tool being warped before any quenching stresses occur. It is obvious that this problem cannot be eradicated completely, as the product shape, of necessity, limits the tool design. In the same way, the rate of cooling will have a similar effect; the thin sections will be stable before

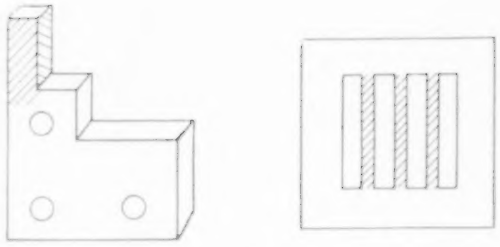
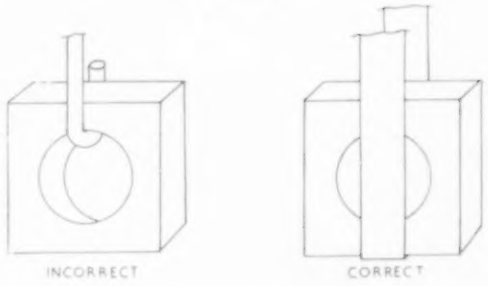


Fig. 10.—Illustrating effect of shape on warping

Fig. 11.—Correct and incorrect method of suspending tool in salt bath



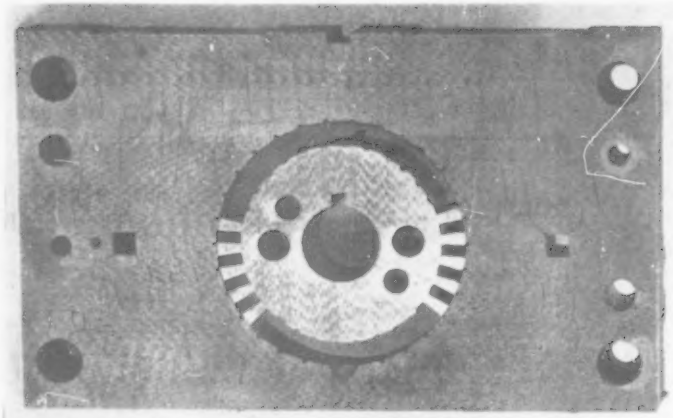
the thick sections have completed their contraction-expansion cycle, so, the slower the rate of cooling the better. The ideal cooling rate would obviously be one where all areas of the tool reached the hardening point at the same time, but again this is not generally possible, so as efficient a compromise as possible is sought. In the author's experience, with tool steels of the type with which this paper is concerned, the general volume changes from structural formation, rather than from distortion, vary from −0.005 in. to +0.005 in. according to the type of steel, its quality and the method of heat treatment. Oil-hardening steels, for instance, of the 1 per cent C., 0.5 per cent W. variety, usually exhibit a small shrinkage when oil-quenched, but the same tool may " grow " if subjected to a Mar-tempering treatment. These contractions and expansions are, in the author's experience, very unpredictable; the general tendencies follow the classic theory for the steel analysis concerned, but, in practice, when tool hardening is done on a commercial scale, results frequently exceed the theoretical expected limits.

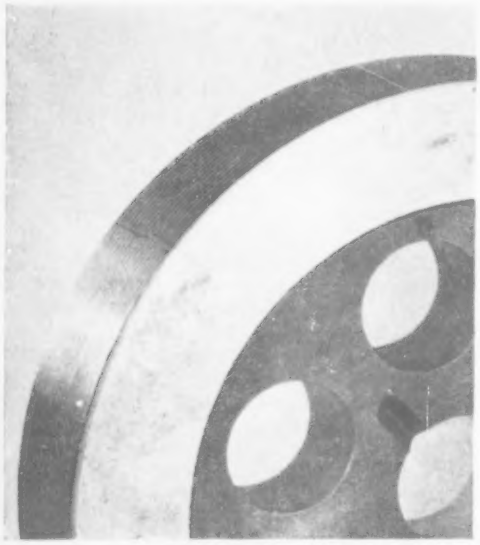
An interesting aspect is, of course, that these characteristics can be utilized in the rectification of tools and the author has on some occasions effected a growth in an undersized tool which prevented it being scrap, and, of course, the opposite.

There are also ways in which distortion can be introduced in the practical side of heat treatment,

Fig. 12 (right).—Grinding cracks

Fig. 13 (below).—Highly-alloyed tool; cracked in service after grinding





which, while they may appear self-evident, are often overlooked. Typical examples are inadequate support for tools in furnaces or salt baths, more particularly in salt baths. The practice of letting a tool suspend in salt as shown in Fig. 11 allows the weight of the tool to be carried by the hole, which can result in distortion. The use of one-sided air blasts for cooling air-hardening steels sets up un-even cooling rates. The use of too great an agitation rate in quenching baths, whether they be salt or oil, can set up distortion.

The point the author has tried to establish is that there are many factors which can give rise to distortion and size change in a tool; apart from these, however, there is also the question of distortion occurring as the result of stress being induced by heavy machining, or stress relieved as the result of heavy machining. In the first example, stress is introduced into a tool by the energy input of the cutting operation; this can cause an unsymmetrical stress pattern in the tool which is relieved during heat-treatment with some form of distortion occurring. In the second example, stress may be inherent in the steel before cutting either from the steel manufacturer or as the result of clamping. Whichever way this stress occurs, the remedy is simple—always make a tool so that after it is roughed out it can be annealed and the distortion allowed to take place, to be corrected in the final machining operations.

Problems Arising from Heat Treatment

The problems which arise after heat treatment are generally associated with stabilizing and finishing and here it will be appropriate to discuss retained austenite, and the effects of grinding, etc. These aspects become very important with the highly-alloyed air-hardening steels. Reference should be made to Figs. 5 to 8 which illustrate the various structures formed in steel. It was mentioned that retained austenite could give rise to a soft skin; it can also exist together with the hardened martensite and this is almost always the case with highly-alloyed steels. This retained austenite is generally unstable and ready to transform to martensite. A method of dealing with this is to low-temperature treat the tool before tempering. Solid CO_2 is frequently used and the tool is cooled to -75° C. At this temperature the unstable austenite transforms. Once this low temperature is reached, it is important that the steel be tempered as quickly as possible. A problem which can occur if the factor of retained austenite is ignored, is that a tool could be hardened and tempered with the structure still partially austenitic; then, if finally ground, the grinding can convert the austenite into untempered martensite. This is

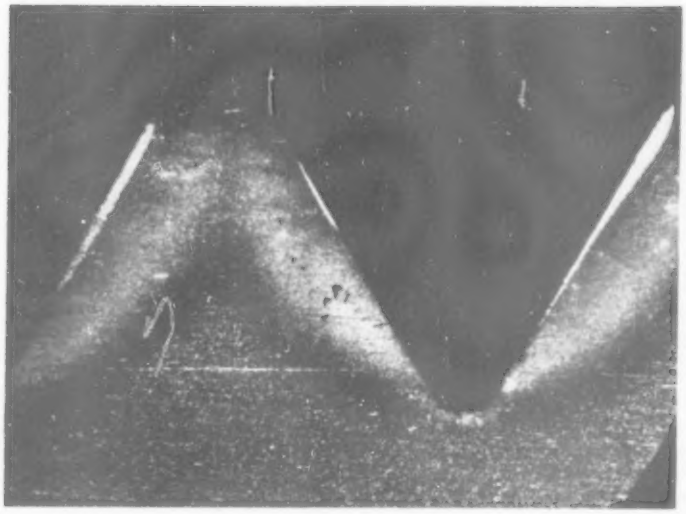


Fig. 14.—Edge of tool shown in Fig. 13

possible as a result of the stress induced by the grinding action. With a blanking tool, for instance, the presence of such untempered martensite, even in proportions as small as 5 to 10 per cent, can cause minute cracks to occur and to initiate edge flaking. In an unground tool, the blanking load itself can influence the transformation with the same end result. A more stable retained austenite can have a different effect; it can dull a blanking edge or, on a drawing tool, it can increase the possibility of scoring. All these aspects have convinced the author that sub-zero treatments are a necessity, not a luxury, for the tool-room heat-treatment department.

The principle of double tempering also hinges upon the formation of unstable retained austenite. It is possible during the first tempering operation to convert retained austenite into untempered martensite—the second tempering operation tempers the secondary martensite. In the author's opinion a third temper is not a wasted effort with certain of the more highly-alloyed steels.

An aspect of grinding is the formation of grinding cracks and these are too well known to require emphasis. Fig. 12 illustrates a typical formation. A point often made with regard to the grinding of tool steels is whether it should be done wet or dry, and many points of view are put forward to justify both methods. In the author's opinion, however, the safe method is to dry grind, but if coolant is used it must be used *copiously*. With highly-alloyed tools, especially those containing tungsten, heat transference is relatively sluggish and it is possible even when wet grinding to heat up at the surface of the work sufficiently to form austenite, which is quenched by the coolant into martensite and not necessarily with the formation of any revealing cracks. Fig. 13 shows a tool which cracked in service and examination of the edge (Fig. 14) showed that martensite had been formed as a result of excessive heating during grinding. This untempered martensite initiated the service cracking. In this case it was not definitely known whether cooling was used or not, but the end result is the same. The temper colour which would occur with dry grinding if over-heating was occurring would soon warn the operator to modify his technique. Inadequate supplies of coolant merely prevent the formation of a temper colour without necessarily protecting the surface actually being ground.

SURFACE TREATMENTS OF TOOL STEELS

There are a number of surface treatments which can be applied to the tool steels we have considered but, in the author's experience the results are not always predictable. In the main these surface treatments are applied to reduce the tendency for scoring between the work piece and the tool. This failure is also referred to as scuffing, galling, pick-up and fouling. The same problem exists under many names, and it is a serious one in forming operations. In the author's view any attempt to minimize such trouble should start with keeping tools clean and lubricated. The physical mechanism behind scuffing is complex but it can be stated fairly simply that it commences when the lubricant does not act as a barrier between the work and tool. The two materials coming into intimate contact, at high speeds and pressures, weld together and then are torn apart, once this rough surface has been initiated the defect becomes progressively worse.

If this mechanical pattern is accepted then any foreign matter which is allowed to exist on the

surface of tool or work will have a similar effect and cause the initial surface rupture which starts the scoring. It is not the author's intention to discuss methods of tool lubrication but to emphasize the necessity of maintaining adequate lubrication; which does not mean an occasional wipe of work or tool, with a dirty piece of oiled waste rag (and anyone who has been concerned with press-shop troubles will know that this is not an exaggeration).

There are many discussions as to the type of finish required on tools to give maximum efficiency, especially with pressing tools; in particular whether a high polish is more effective than a matt surface. In the author's experience this is secondary to the lubrication; if the lubrication is adequate, both types of surface will give good tool life, but in the absence of good lubrication then the smoother surface should be adopted. The smooth surface will be lacking in sharp surface irregularities which could lead to cold welding, and the formation of such defects, is then postponed. From this it can be further stated that a rough surface is more likely to rupture the lubricant film and give rise to scuffing than is a smooth surface and in general this is true, but it will often depend upon the particular operation being done.

It has been postulated that, despite adequate lubrication, the physical nature of the two mating surfaces will affect the tendency for scuffing to occur and this is why surface treatments such as nitridings and chromium plating have been used: each provides a surface which is chemically different from the normal steel. In the case of chromium plating, the deposited pure metal is extremely hard; nitriding provides the formation of iron nitrides in the surface of the tool. A fairly recent technique, " Sulfinuze," forms a sulphur-rich layer. It may well be that the chemical nature of the surface formed does delay the cold welding but, on the other hand, it could be that in the case of the chromium and nitrogen the property conferred is related to the heat resistant properties of these materials. It is a well known fact, that in the die-casting field a nitrided tool will resist heat cracking on the surface for longer than an un-nitrided surface. Chromium, of course, is well known for its heat-resistant qualities and the temperature that is reached when two metal surfaces come into free contact is very high.

When all things are considered the author is of the opinion that all those treatments are palliatives for the lack of lubrication and that much more economy in tool maintenance will be had by an adequate dispensation of lubricant than by any surface treatment. If these treatments are viewed in that light then their added protection value is in correct perspective but that tool designers who expect them to compensate for poor lubrication are not really going to be successful.

To sum up these sections dealing with tool treatments it is necessary to emphasize the following points:—

1. Do follow manufacturers' heat-treatment instructions.
2. Do stress-relieve tools before final machining.
3. Do sub-zero treat highly-alloyed steels for maximum requirements.
4. Always carry out at least two tempering operations.
5. Lubricate thoroughly and continually.
6. Do consult the steel manufacturer before deciding upon a grade of steel; it does not cost anything and it may be useful.

The Selection of Tool Steels

As was said at the beginning of this paper the selection of a grade of steel for a particular application will be determined by two main requirements of the job being done and the manufacturing process concerned. The process can be blanking, punching, forming and drawing of materials ranging from brass to stainless steel. Each process will require differing properties in the steel and each material has its own peculiarities.

In attempting to decide upon specific applications the author found it difficult to decide what to omit and what to use and as the points should be germane to those attending the conference, it was felt that interests could be best served by attempting to answer specific problems that are being met by those present.

In conclusion, the author would like to thank Mr. I. Engler, Managing Director of Söderfors Swedish Steel Co. Ltd., for permission to present the paper.

Reference

(1) Tool Materials for the Cold Extrusion Process. (Institute of Sheet Metal Engineering.) *Sheet Metal Industries*, 1961, March, pp. 190-207.

DISCUSSION

Mr. J. PALFREY (W. and T. Avery Ltd.) asked whether he had heard Mr. Comley right in saying that ordinary carbon tools were being replaced by more alloyed steels. He referred to the work of PERA, who had carried out a great series of tests, and their results were that silver steel gave twice the punch life.

Mr. COMLEY said that the PERA statement was based on a laboratory test. But the proof of the ascendancy of the alloy steel over the carbon steel was to be found in the toolmaking business. He could assure Mr. Palfrey that in any steel company in the Midlands, by far the greatest stock was of alloyed steel. Silver steel was very good for punches,

and it would do a good job, but he was sure that an alloy steel would last far longer.

The CHAIRMAN (Mr. T. W. Elkington) said that in the last 30 years the accent had been on non-distorting steel; before alloy steels, carbon steels and tough-cast steels were generally used; they did harden exceptionally well. With the coming of grinding, there was a good chance that some of the old tough-cast steel would come back.

A SPEAKER asked if, as a cooling medium, it was a good thing when vegetable oil went out and mineral oil came in?

Mr. COMLEY said that it was certainly a good thing from the point of view of the man who to smell it! He thought heat treatment practice to-day was as far ahead of the old practice as was presswork. The old quenching oils were used because they were more readily available. The firms producing quenching oils to-day had produced something which in his opinion was very, very good. The only problem was that when you put a piece of red hot steel in it, some of the oil was oxidized, and eventually the thermal efficiency of the oil was reduced by the formation of these oxides, and the oil had to be changed at adequate intervals, depending on the amount of work going through the plant.

Mr. MCKAY asked the author to elaborate on sub-zero treatment.

Sub-zero Treatment of Tools

Mr. COMLEY wanted to make clear that what he had stated was a personal opinion. He knew that sub-zero treatment of tools had been erratic; particularly in the field of cold extrusion of steel, sub-zero treatment had given very funny results. In all the tests he had carried out personally, and on the results of watching tools through a press shop, there was no doubt in his mind that one of the biggest contributing factors to failure in highly alloyed steels was retained austenite, and frequently the sub-zero treatment was the only way of making sure that retained austenite was reduced to an absolute minimum. He would not argue technically on how often it worked; he thought sometimes there was retained austenite which was not changed—it might be very stable.

Most of his work had been in solid CO_2 alone or in alcohol. Usually the tools had been there overnight at various times; sometimes for two hours; it depended on the size of the tool. He wished to emphasize that once the tool was removed, it had to be tempered very quickly. For a two-inch punch he had found it necessary to have a two-hour treatment; this was distinct from sub-zero treatment done for the stabilization of very accurate gauges.

Mr. J. F. KAYSER was a little disappointed in the paper because, as far as the steels were concerned, with the exception of those containing cobalt and a high percentage of molybdenum, all of them were in regular supply before 1916, and those containing cobalt and molybdenum were quite fairly developed by the end of 1917. The author said: "Nickel is only present in tool steels when added as an alloying element". That was perfectly true in 1916, but it had not been true for many a year since, not even in the case of Swedish steels, because all steel manufacturers used scrap, even in Sweden, and the nickel and copper contained in all steels was steadily growing. Many years ago he knew quite a good steel with some nickel in it.

As regards alloying, and as far as cutting tools were concerned, he agreed that in very light work there was perhaps not much point in adding small percentages of tungsten and chromium; but they had a vital effect on the change of dimensions from hardening.

Tool steels were generally supplied annealed after being forged or rolled from the ingot. If they had been properly annealed they would show laminated pearlite; if they had not, they could show gross carbide. Silver steel—he was not thinking of bright ground which had most probably been drawn—had a very different structure. Did not the author think it might be advantageous for tool-steel manufacturers to supply steel in the sorbitic state, because if it were, he thought it could still be machined relatively easily, and it would respond more readily and rapidly to heat treatment, because the carbon was in a much finer state of division.

Referring to the sub-zero treatment, he could refer the author to a patent, about 10 or 12 years ago, of a Swedish company, dealing with sub-zero treatment of high-chromium steels. It was better rather to over-heat, and then, certainly within an hour, deep freeze—solid CO_2 in methylated spirit was very suitable; it was a liquid bath, and there was no need to maintain that temperature; then it could be tempered the same day.

Mr. COMLEY said that he would send Mr. Kayser some typical cast analyses of Swedish steel and also of English steel in which there was no nickel. The point of the remarks in the paper was for the benefit of anyone who was not aware of the basic uses of elements in tool steel, and in his opinion there were many people who used tool steels who did not know enough about that question. He was not trying to be dogmatic, but just to give a general guide. He had meant the paper to be contentious.

With regard to silver steel and alloy steel, he thought the equivalent cross-sections were very much the same. One difference occurred with punch dies of one, two or four inches diameter; there was no doubt that gross carbide did exist; he doubted if anything could be done about it in the hard alloy steels once it was there. He had seen references to high temperature heat treatment to produce a higher solubility of carbide. He thought

these things were best carried out on the laboratory scale and very adequately proved before being put in the hands of a heat-treating firm. In regard to silver steel, the one per cent carbon had a very fine carbon dispersion; he did not think it was any better than the silver steel or the round stock which was now available.

Mr. COMLEY agreed that far too much steel was supplied annealed; tool rooms did not take advantage of modern machining methods which would enable them—not so much in the case of the process being discussed to-day, but in other processes—to buy steel and not heat treat it at all. He had not given it sufficient thought to say whether, in terms of an ordinary die steel which had to be subsequently hardened, the use of the sorbitic structure would be desirable. He would like to give some consideration to that question. In his experience, once one departed from a fully annealed structure for heat treatment, the danger of quenching cracks did increase; from that point of view he did not like the idea, but it was a thought.

Mr. D. BOXALL (B.N.F.M.R.A.) wondered whether Mr. Comley would agree that the point about using nickel was that one did not need nickel because one did not need great depth of hardening. If one was heat treating a die, then one did need the depth of hardening, and one depended on nickel and chrome to harden to a depth of 4½ inches. An 8-inch diameter bar could be hardened to the centre. With small blanking tools, this hardening ability was not needed.

In his introduction, Mr. Comley had said, "If you consult 20 manufacturers, you will get 20 different recommendations". In his paper he said, "Do follow manufacturer's instructions". Some years ago, when he was responsible for a lot of heat treatment, he had found he could ignore the manufacturer's instructions; they seemed to be based on very old-fashioned practices. For instance, they said the steel should be soaked for 24 hours, and he found he could cut the treatment down to something like three-quarters of an hour in a salt bath, and the results had been entirely satisfactory.

Fig. 11 showed what the author believed to be the correct and incorrect methods of suspension. Mr. Boxall had literally thousands of dies of that shape suspended in the "incorrect" manner, and the results had been entirely satisfactory. Solid hooks had not been used, but fine steel wires. The grinding allowance might have been a bit larger, but it had been all right.

Nickel as a Hardening Element

Mr. COMLEY agreed that nickel was used as a hardening element in the forging industry. He was not certain in his own mind as to the advantage of nickel in those steels in regard to the toughness it imparted under those conditions.

He had said, "If you ask for a type of steel to do a given job from 20 different manufacturers you will get a varied number of steels offered to you". He had not been referring to the heat treatment. In his paper he specifically said, "Consult your steel manufacturer". He agreed that some leaflets carried details of heat treatments which were sometimes unnecessarily elaborate. He was talking about instances where heat-treatment facilities were primitive, and it was almost impossible to instil into whoever was doing it that the job should be carried out properly. Very often in a large organization there was a bad lack of communication between the tool designer and the heat-treatment shop; sometimes to such an extent that the tool was not made in the firm, but put out on sub-contract, and it would be put out by a buyer to the cheapest toolmaker. The situation could arise where the tool was designed by one person; was made by a different firm; and heat treated by another firm, and there was lack of communication all the way down. The same thing could happen in large organizations, such as the motor-car industry; the tool could be made 200 or 300 miles away, if there was a toolmaking shop in the group. Under these conditions the tool could be distorted by the heat treatment because the person concerned had not been told that that particular steel required slightly different heat treatment from another steel. For instance, some steels responded better to oil and some to salt.

Mr. COMLEY assured Mr. Boxall that if he were in the field they were discussing—high-speed blanking and pressing—and if he were heating up dies of that shape on a hook consistently in a salt bath, once they were heated up to 1,000 degrees, and the whole thing was carried by the top, it would distort. It was just as easy to do it the correct way, and there seemed no point in not doing so.

One could not be dogmatic about how a piece of steel was going to react. He had seen tools which he fully expected to come out looking like a corkscrew, and they had come out perfectly; and he had seen exactly the reverse. The thermal and mechanical treatments all tended to distort the tool. However, one should get the hardness which was required; that was the purpose of the analysis of the tool. If a well-made, top quality tool steel did not give the required hardness, there was something wrong with the steel or the heat treatment.

Asked whether there was not a case for rationalising the compositions so that the twenty compositions could be cut down to five, Mr. COMLEY replied that in the cold field, five steels would cover every item he could think of.

Mr. D. R. MEAR quoted the paper where the author said, "When all things are considered, the author is of the opinion that all those treatments are palliatives for the lack of lubrication". That seemed

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to intimate that if one could not get hold of adequate lubrication, and extremely good lubrication, for any material or product one was going to produce, one may as well not bother to consider it. In other words, the author had mentioned surface treatments, and then said the main thing was lubrication.

Mr. MEAR said that he worked in a research department which was concerned with the manipulation of what were known as the newer metals, and with some of them it was almost impossible to produce perfect lubrication conditions, and therefore they had to try to get over this. The author had said he got over it in most cases by using the dearest material available, tungsten carbide. Where only a very small amount of work was being done, this would be very expensive. One alloy—copper-manganese-aluminium alloy—when being manipulated in pressworking or in drawing, nearly always gave trouble with lubrication. Could the author amplify the treatments, and say what was the best thing to do about producing a surface which was extremely hard and would take a very high polish.

In defence of what he had said, Mr. COMLEY replied that the whole of his paper was entirely directed at high-speed blanking and pressing in modern industry. His remarks were not necessarily valid outside the context of the meeting. There was a belief on the part of some people that by chromium plating or case-hardening a tool surface, there would be a drastic improvement in the life. His experience was that where a tool had been adequately hardened and lubricated and maintained properly, then the other treatments did not make a great deal of difference. Where the lubrication was spasmodic or non-existent then the addition of a surface film did make an improvement. He had modified his statement by saying that these treatments should be used not to replace lubrication, but together with lubrication. Obviously there were certain fields where chromium plated tools worked very well, such as in the tube drawing industry.

He thought that in the press shop lubrication should be treated seriously, which was not always the case. He had been appalled at the way some press shops had considered the problem of lubrication.

Merits of Surface Treatment

As regards the merits of surface treatment, he was undecided with reference to press tools. He had seen some very disappointing results. Chromium plating had to be done properly, and the tool treated properly, and it had to be of the right hardness.

Mr. J. GALWAY (Kearney, Trecker (C.V.A.) Ltd.) said one of the problems associated with high-speed piercing and blanking was the pick-up of the component material on the punches and dies. Very often with materials such as nickel, it did inherently pick-up on punches and dies, and people would say such-and-such steel was very good for working with nickel, the inference being that there was some content of that steel which made it less liable to pick-up. Was this a fact or just a coincidence?

Mr. COMLEY replied that nickel alloys were notorious for picking-up, and they did pick-up badly. With regard to whether a particular supply of steel would be better, he thought it was, in general, highly improbable. He thought almost every major supplier of tool steel to-day in this country made compositions which they had decided on by experience, and those compositions did not differ a great deal. There were, of course, degrees of hardness for any apparently equivalent grades of steel. When there was a complaint, he would like to know whether everything else was equivalent—the hardness of the nickel strip, and the conditions of lubrication. Lubrication helped to eradicate pick-up of nickel alloys.

NEW PLANT AT TIPTON STEEL STRIP FACTORY BOOSTS EXPORT DRIVE

A NEW line of hardening and tempering furnaces and ancillary plant has just been brought into commission at the Tipton, Staffordshire, factory of Firth Cleveland Steel Strip Ltd., a member of the Firth Cleveland Group.

This step increases the company's output of wide hardened and tempered steel strip by 33⅓ per cent, and most of it will be going to the export market.

Even more significant is the fact that Firth Cleveland Steel Strip Ltd. will now be able to supply hardened and tempered steel strip up to a maximum of 18 inches wide and 0.096 inches thick, compared with a previous maximum of 13 inches wide and 0.080 inches thick.

Advantages of Increased Width

The new maximum width brings many great advantages. For instance, it opens up a market for the supply of British hardened and tempered steel strip for the manufacture of wide bandsaw. Until now, this could only be obtained from Swedish steel strip suppliers.

Firth Cleveland Steel Strip Ltd. have existing cold rolling mills capable of handling steel strip up to 13 inches in width. To feed their new hardening and tempering plant with cold-rolled carbon and alloy steel strip of up to 18 inches in width they will be able to call on their associate company, J. J. Habershon and Sons Ltd. of Rotherham. The marketing interests of both companies, together with those of The Tenuous Steel Co. Ltd. and The Edmonton Steel Strip Co. Ltd., are looked after by Firth Cleveland Steel Ltd., Rotherham, Yorks.

Dry-film Lubricants—Discussion

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when contemplating the use of dry-film lubrication.

He would not argue about the validity of Hundy's formula, but possibly it was near enough right, in the general context, to show that this relationship did exist and that in the temperature ranges of lubrication application, the strain-ageing time was reduced vastly.

Mr. D. R. MEAR (I.C.I. Ltd., Metals Division) said he had recently done extensive trials over the last twelve months with other types of dru lubricants, using mainly non-ferrous metals, and he had found, generally, that, certainly on very deep drawing, the static coefficient of friction was no guide whatsoever; what was needed was the static coefficient of plastic deformation, on which no information existed at all.

He was interested in the discussion in the paper on the action of conventional lubricants and that of other types, because he had come round to a "half-baked" type of theory that the lacquers and plastics they had been investigating acted as a barrier lubricant, and therefore the coefficient of friction appeared to have no significance at all. He had used PFTE which had a phenominally low coefficient. He had been puzzled in that when he had high deformations with a reasonable amount of heat produced, the solid film actually melted, and the lubricant action was by shearing of the film over itself. That would imply that one was left with some of the lubricant on the tools, and some of the lubricant sheared and stayed on the product itself. When using a lacquer, he found he had a very fine glaze of lacquer over the surface. This was probably the result of using an excessive thickness of coating. He had done a fair amount of work on the thickness of the film which the author had got round by saying, "People have to experiment". He had found that if an extremely thick film was used, of the order of 0.001 in., about half of it scraped off, and after about 50 products there was no hole left in the die.

Reaction of Solid Lubricants

He wondered if the author could expand on the remarks on how the reaction of these solid lubricants work, because he himself had no idea, although he knew they did work.

Mr. CLARKE replied that, in regard to static coefficient, he had only put that in for some sort of identification; he was not suggesting it was a very reliable factor in a drawing lubricant. With regard to dry-film lubricant, his own feeling was that the heat generated probably came from the deformation of the blank or the component; therefore one could say it was the inner side of the film which melted first. It was the inner side, which was molten, which would give that sliding barrier, without melting necessarily occurring on the outer side of the film. Probably with a lacquer there was complete melting because there was a lower melting point.

Mr. MEAR agreed, because they were talking of films the order of 0.0002 or 0.0003 in. Could the author give any idea of the sort of thicknesses he had been dealing with when putting on something for fairly severe deformations?

Mr. CLARKE: About 0.0005 in.

The CHAIRMAN (Mr. T. W. Elkington) thought there were so many variables, that they should have a criterion. He wanted to ask Mr. Clarke whether there had been compiled any sort of reference data; because the sheet had to be right, the coat had to be right, the drying had to be right; in the end it became very complicated as to whether one was going right or wrong. Could Mr. Clarke give any yardstick or formula?

Mr. CLARKE replied that, generally speaking, it was essential that cleaning prior to lubricant application was of a very high standard; before any press operation was carried out, the film had to be absolutely dry to the touch; from the point of view of the starting point of film thickness, it was best to start in the higher ranges and work down; no trouble would normally ensue from that; it was largely a matter of economics; in most instances a too-thick film would not give any trouble under the presses.

Asked if he could give any information on the use of dry-film lubricants for deep drawing at elevated temperatures of the order of 200 or 300° C., Mr. CLARKE said that these types of lubricants had been used on some components which, on being taken from the press, were too hot to handle; how near that was to 200 or 300° C. he did not know. Hazarding a guess, he thought they would be satisfactory.

The CHAIRMAN, in closing the discussion, thought a particular worth-while point had been made in the paper when Mr. Clarke had mentioned that the centralized lubrication made a saving in press production output, and also in the cost of the actual compound. There was no argument about that, because everyone knew how much wastage took place in press shops on those particular aspects.

BRITISH STANDARD SPECIFICATION FOR ROLLED COPPER SHEET, STRIP AND FOIL

THE British Standards Institution has just published a revision of B.S. 899 covering rolled copper sheet, strip and foil. The new revision has extended the standard's scope to include material for electrical purposes in the form of rolled sheet and strip. This material was previously covered by B.S. 1432 which is now being revised. Its scope will be restricted to strip with drawn or rolled edges.

METHODS OF RATING POWER PRESSES

By E. HAMILTON*

A paper presented at the Annual Conference of the Institute of Sheet Metal Engineering, Birmingham, November 7 to 9, 1961)

THIS paper will be confined to the mechanical power press. A hydraulic press certainly comes under the general title of "power press" but its rating is quite simply rated tonnage for the stroke of the machine in contrast to the many variables of the flywheel drive press.

Mechanical power presses are made in a variety of ways but they all have certain fundamental common features which have a bearing on the way they perform and on the rating of the machines.

Almost without exception, crankshafts or eccentrics are used in the press drive mechanism to impart the final motion to the ram.

It follows that the speed and mechanical advantage of such a mechanism must vary throughout the stroke of a press. For this reason, the capacity of a press is not defined properly unless the distance (or angle) before bottom dead centre, at which the machine will exert its rated tonnage, is also specified.

Reference to Fig. 1 will make this point clear; if the drive gears and cranks or eccentrics are designed to deliver full tonnage at, say ½ in. from B.D.C., then the torque necessary to sustain this load is also fixed and is equal to the product rated tonnage multiplied by "X". It will be seen that if we now consider a point higher in the stroke, "X" increases to "X_2" and so the press load, which the drive will sustain, is reduced if the torque rating is not to be exceeded.

The way in which the permissible load varies is best illustrated graphically as in Fig. 2.

Although press makers mark up the rated tonnage on their machines, seldom does one see the distance from B.D.C. indicated. The question naturally arises as to who specifies this important dimension and on what basis. It would seem that years of experience of both press builders and users have led to the adoption of an agreed standard for stroke tonnage rating, which seems to fulfil the needs of most press shops for the general run of components, although probably the biggest single factor would be the needs of the automobile industries.

Some years ago, in the U.S.A., joint industry conferences were organized in an attempt to get agreed standards of dimension and rating of various types of equipment. The joint industry conference

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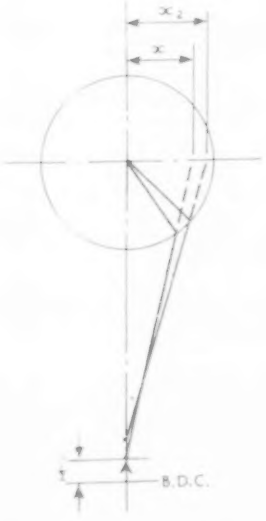
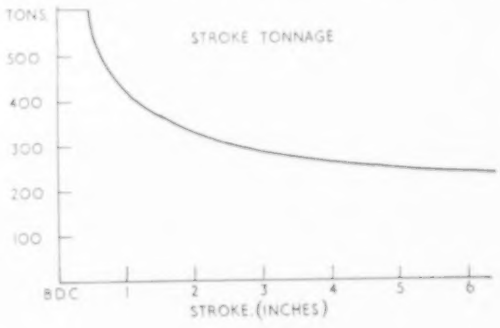


Fig. 1 (left).—Diagram showing method for correct definition of press capacity

Fig. 2 (right).—Variation of permissible load with stroke



on punch stress standards published recommendations on stroke tonnage ratings which are shown in Table I.

TABLE I. — *Distance from bottom of stroke for rated capacity. American Joint Industry Conference on Punch Press Standards*

Open-back inclinable presses		
Tonnage	*Non-geared*	*Geared*
22	$\frac{1}{32}$	$\frac{1}{4}$
32	$\frac{1}{32}$	$\frac{1}{4}$
45	$\frac{1}{16}$	$\frac{1}{4}$
60	$\frac{1}{16}$	$\frac{1}{4}$
75	$\frac{1}{16}$	$\frac{1}{4}$
110	$\frac{1}{16}$	$\frac{1}{4}$
150	—	$\frac{1}{4}$
200	—	$\frac{1}{4}$

Single-action and Multi-Point	
Single-end geared	$\frac{1}{4}$ in. from btm.
Twin-end geared	$\frac{1}{8}$ in. from btm.
Eccentric	$\frac{1}{4}$ in. from btm.

Double-action Single and Multi-Point	
Inner Slide	$\frac{1}{8}$ in. from btm.
Blank Holder	$\frac{1}{4}$ in. from btm.

These have since been used in this country and the U.S.A. as an acceptable basis for press rating, although certain automobile press shops have recently been specifying single-action presses rated one inch from B.D.C. on longer stroke presses.

Certain continental press manufacturers rate their machines at 30 deg. crank angle from B.D.C. which, on strokes greater than 8 in., gives a distance greater than $\frac{1}{2}$ in. from B.D.C. for rated tonnage.

There is obviously a need in certain metal forming operations for presses with drive rating heavier than J.I.C. Standards; cold extrusion of steel is an example where full tonnage is needed several inches from B.D.C. but of course, such machines are more expensive to manufacture. On the other hand, certain specialized machines, such as blanking presses, are adequately rated at $\frac{1}{4}$ in. from B.D.C. Apart from economies in the drive gears, to rate these presses at $\frac{1}{2}$ in. would aggravate inertia problems arising from higher working speeds on such machines.

The effect on press tonnage of blankholding equipment should not be overlooked. On single-action presses, pneumatic cushions are often fitted for blankholding; unless otherwise specified, the cushion tonnage must be subtracted from the rated load of the press when evaluating its suitability for a specific operation. Further, the point in the stroke at which the blankholder is brought into operation must be considered, since for drawn work this point is likely to be some distance from B.D.C. Reference should be made to the tonnage/stroke curve for the press under consideration.

Energy Rating or Work Capacity

Tonnage ratings in a typical press-shop producing stampings for passenger vehicles, range from 50 to 1,250 tons single action and from 300 to 1,800 tons double action.

It follows that the torque requirements of such press drives are also of a high order and could not be supplied by a reasonable size of motor. For this reason, flywheels are used which will deliver the peak torque demanded by the job; the energy lost is replaced by the motor between working strokes.

The energy needed for a pressing operation is equal to the product of the average force required and the distance through which this force has to be exerted.

In addition to the energy needed for actual metal forming, pneumatic blankholders on single-action presses have to be displaced and some energy is lost at the clutch and brake in the form of heat.

Single-action presses are rarely purchased for the forming of one particular component, but must, as a rule, be capable of a variety of work ranging from blanking to draw-work. For blanking, the energy required is comparatively light, in draw work it can be considerable.

It follows that the energy rating for a given press tonnage is not a fixed quantity as is the torque rating for the transmission; it will vary with the stroke of the press, the cushion tonnage, the characteristics of a particular machine, and the horsepower of the drive motor.

The press manufacturer has to compromise on a general-purpose machine and choose a flywheel that will cater for a reasonable depth of draw consistent with the stroke of the press.

It is always advisable to inform the press manufacturer if any of the work envisaged requires a large amount of energy.

As a general rule, the biggest consumer of energy is the pneumatic blankholder and this factor sets a limit to the usefulness of single-action presses for draw work; this is possibly also the reason that the J.I.C. Standards referred to previously recommend a maximum blankholder capacity of 1/6 of press tonnage.

The energy required for the outer slide on a double-action press is negligible since the slide remains stationary while the job is drawn by the inner ram.

Flywheel size for this type of machine varies with the tonnage of the inner ram and its effective length of stroke for drawing.

Speed of Operation

The largest factor determining the nominal strokes per minute of a press is the limiting speed at which the material under consideration can be deformed. This applies more to draw work, where plastic flow takes place, than to blanking.

For blanking, the allowable slide velocity is high and the limiting s.p.m. are dictated by machine dynamics. In addition, the fact that short strokes are quite acceptable for blanking, which reduces the slide velocity and machine inertia forces, so that s.p.m. in excess of 200 are common for small blanking presses with automatic feeds.

For drawn work, the limiting slide velocity varies from about 30 ft. per min. for stainless steels to 80 ft. per min. for certain deep-drawing steels.

As a general rule, the speed at midstroke is fixed at 50 to 60 ft. per min. Thus a 16-in. stroke press would run at a nominal speed of 15 strokes per minute.

The maximum number of working strokes which can be taken from a press in a given time is usually less than the nominal figure referred to above, if the press is started and stopped for every operation, which is usually the case with hand-fed presses.

Apart from the inherent time lags involved in stopping and starting, the chief reason lies in the fact that friction clutches and brakes are used to control presses of any size.

Each time a friction clutch starts the press mechanism moving, a definite amount of energy is lost at the clutch plates in the form of heat; this also applies to the brake when it brings the moving parts to rest.

With the increasing use of automatic handling on press lines, the time between working strokes has been reduced, and improved designs of clutches have been developed to meet these conditions.

Nevertheless, the problem of keeping the heat generated within the limits of existing materials is difficult and is acknowledged by the larger press users to the extent that they insist on a performance of 80 per cent; that is to say, a press with a nominal s.p.m. of 20 should be capable of 16 working strokes per minute.

DISCUSSION

Mr. WOODCOCK said that although he knew very little about power presses, it seemed to him that small presses making many parts worked at what he considered to be very low speeds. Was there any reason why presses with feeding arrangements, making washers or small pressings, should go very slowly.

Mr. E. HAMILTON (Wilkins and Mitchell Ltd.) said there was no reason why very high production rates should not be achieved, although sometimes it did need a special design. It might be that the rate of deformation of brass or steel limited the speed.

Mr. MCKAY was of the opinion that British press tool-makers were lagging behind. Tools were becoming more precise, and were capable of giving fine finishes. European press makers seemed to be a little more alert to the change which was taking place and seemed to be supplying a need, and the British were not doing so.

Mr. HAMILTON thought Mr. McKay was right to a degree; certain Continental firms had for many years specialized in that sort of thing. But there were signs that certain British firms were tackling the problem; his own firm were attempting to do so in a small way, but it required quite a few years of development work. The press makers themselves were not necessarily equipped as experts on tooling, but there were signs that this was being remedied—a little slowly, perhaps.

Mr. KAYSER quoted: "It follows that the speed and mechanical advantage of such a mechanism must vary throughout the stroke of a press"—that was using a crankshaft or eccentric. That was not the case as a toggle arrangement could be used to load a spring. It seemed to him that the way most presses were made was rather futile, because the maximum mechanical advantage coincided with the zero velocity. Why did not manufacturers avail themselves of the velocity; they could take some presses, for instance, and try to inch them round; they could put on what torque they liked, but it would not work. But put some velocity behind it, and make use of $\frac{1}{2}mv^2$, and the job could be done.

The author had said that the press manufacturer had to compromise on a general-purpose machine; there was no law that said so. There was a complete inability to appreciate the fact that in this country—and others—there were large numbers of people who wanted a press for one purpose only; for instance, people who made bottle closures—millions of them—did not want a universal press. There was evident need for specialized presses and not general-purpose presses, and this applied also to blanking.

Mr. HAMILTON said he was merely stating facts as they were, not as they could be. It was a fact that most presses, particularly the larger ones with which he was associated, did use the eccentric or crankshaft for the motion. He had no doubt that other ways could be devized, but that happened to be the way they had got into business, and many people demanded that sort of machine. Their biggest customers were the motor car trade, and they had asked for presses of certain types. He would not say that somebody could not lead the field in designing a revolutionary piece of mechanism. However, he did not think it was conservatism and nothing else; there were many advantages with regard to the power that could be obtained.

Blanking was a different thing; he could only suggest it was a matter of convenience and convention.

In regard to specialised presses, he said the

manufacturers were in the hands of the market. Many small businesses, and even large ones, had to do a large variety of components on their machines. He had seen quite large machines (144 bolster area, six feet front to back), used for blanking, and the same machine used for six-inch draws, even among the acknowledged leaders in pressing in this country, and companies which had a high reputation for pressings on motor cars.

A SPEAKER asked for the author's opinion on the standardisation of British press ratings, particularly in view of the possibility of joining the Common Market. If the Continental manufacturers were adopting 30 degrees from bottom dead-centre, and we tended to adopt the J.I.C. standards, we were in for a difficult time.

Mr. HAMILTON said that manufacturers were in the hands of their customers. There was no possible use in putting forward a one-inch rated press if the customer did not really need it, because by doing so the transmission would be practically doubled, and gears were expensive. His firm had put on a one-inch rating for a special order, where the customer had insisted.

About 15 per cent of their output went to Europe. His firm made medium to large machines, and in general Sweden, Germany, France and Italy were satisfied with the American ratings.

Mr. WILLIAMSON (F. C. Braby Ltd.) replied to the first speaker as to why a small press did not work faster. One obvious reason was that if the press were worked faster, the parts could not be cleared away in time; second, due to the fact that if the flywheel was speeded up, the kinetic energy of the flywheel would be increased; third, the rest of the press would be over-strained, particularly the clutch.

Mr. J. W. PRIESTLEY (The Expanded Metal Co. Ltd.) asked whether the author found any difficulty in reconciling the tonnage rating of a press with the clutch requirement in regard to speed. Occasionally a press with a very large clutch contained in its mechanisms would break if there were troubles such as interruption of feed or something like that.

Mr. HAMILTON replied that it was a problem. In theory, whatever the flywheel size, if the clutch—he was speaking of friction clutches as distinct from positive clutches—had been assessed for torque, then the clutch should slip before the damaging pressure was built up. In the case of a rolling key clutch or a positive clutch, too large a flywheel would definitely tend to overload. The other outlet on the press was really the frame itself. If the frame would deform elastically at a certain rate, again in theory a condition could be obtained where the load would not build up beyond a certain point. His own company had had a lot of experience in that respect, and they made two types of frame: a rigid one-piece frame, and a tie-rod frame. It did call for very careful tool setting on a machine if the frame was rigid, as opposed to a tie-rod frame.

Mr. BREWER asked if the flywheel would not burst; was not there a limiting factor?

Mr. HAMILTON replied that there was obviously a limit to how fast a flywheel could be run. Flywheels were normally made of cast iron, and, depending on the shape of the flywheel, there was a limiting speed; generally that was at about 5,000 to 6,000 feet a minute. A steel flywheel, or one made of something much stronger, could be run at much faster speeds.

A speaker wondered if high-speed presses were not being made rather elaborately. He asked this because, with the modern dies, if it were a very finely and accurately adjusted punch which had to mate with a very accurately adjusted die, when running at a very high speed, if the two were not absolutely perfectly aligned, there would be difficulties. He had run presses at round about 600 strokes a minute, and he always had difficulty with those presses initially until the slides got worn sufficiently well.

Mr. HAMILTON did not have much experience. He knew the Americans said the guiding arrangements on a high-speed press should be far more accurate.

The same questioner thought the guiding points should be a long way from one another. Mr. HAMILTON said his company built large machines rather than the small high-speed machines, and there were many factors coming into the guidance. On a four-point suspension press there were four eccentrics or cranks, and the eccentrics could be anything up to 40 inches in diameter, and to turn for throw and diameter and all the other variables, timing and transmission, one could be out with the actual crank displacement; it was only a small amount, but it was present. A big machine could not be made to the same degree of accuracy as a small one.

Mr. BOYD asked if the author advocated revealing the energy available from a press for a given flywheel fluctuation. Would the customer make use of that figure. On a modern high-speed press there would be quite a number of figures to reveal; would it be better for a customer to bring forward a range of definite jobs?

Mr. HAMILTON agreed it would be far better to find out exactly what the customer intended to do. Then one could be specific about energy ratings; that was the only proper way to do it. The customer should be told what he was getting, otherwise he was having a very dangerous weapon put in his hands.

REDBROOK TINPLATE WORKS TO CLOSE

Last of the Hand Mills Bows to the Strip Mill

By TOM GREY-DAVIES

BEFORE the end of the present year the last outpost of the old hand mill method of rolling tinplate, the tinplate works at Redbrook in the Wye Valley, will have ceased to function and all that will be left for Redbrook is the honour of being the very last hand-mill tinplate works to exist in Britain, probably in Europe and possibly in the whole world. The all-conquering strip mill has eliminated its last competitor.

The Redbrook Works situated on the Gloucestershire bank of the River Wye a few miles down river from Monmouth has, for hundreds of years, existed as an industrial oasis set amidst the world-famous scenic beauty of the Wye Valley. With its passing the association of this little industrial community with metallurgical industry which has existed for thousands of years will come to an end. The metal working Celts who settled in Britain from 450 B.C. onward arrived rather later in this area but there is little doubt that the extensive deposits of brown hematite iron ores that were to be found on the Gloucestershire side of the Wye were known and used long before the Romans came to our shores. The famous "scowles" near Coleford, the iron mine at Lydney, the Roman iron-making centre of Ariconium near Ross (known as the "Merthyr Tydfil of the Romans"), are only a few of the better-known proofs of Roman iron mining and working in the region of the Forest of Dean, in which Redbrook lies; an area which twice in our history has been the greatest iron-producing centre in Great Britain.

At Redbrook itself metallurgical history has been made and this private and far-sighted little company by extremely wise management and keen craftsmanship have defied the inroads into the tinplate market made by the great strip mills long after all other comparable plants have given up the fight and closed their doors. Redbrook itself has in the past been famous in another branch of the metallurgical field and a copper-smelting works was in active production in this delightful spot during the late seventeenth and early eighteenth century.

The copper ore was mined in Cornwall, shipped to Chepstow and then carried up river to Redbrook, most probably in the famous Wye River "trows". According to historians of that day the copper smelting plant at Redbrook was "managed by Swedes and other foreigners". Interesting links with that era are still to be found at Redbrook. Much of the slag produced during the smelting of the copper ores was cast into a rough brick form and can still be seen built into the walls of the tinplate plant. A large quantity of these copper slag "bricks" were transported down the Wye and thence to Bristol and undoubtedly are still to be seen in the many early buildings which still exist in that famous old city.

An old Custom House a little lower down the Wye from Redbrook is still called Wye Seal House. During demolition of old cottages adjacent to the tinplate plant token coins of the Company of Copper Miners in England were found and are now in a Bristol museum.

Copper smelting ceased at Redbrook before the end of the eighteenth century and the iron industry again came to the fore.

In 1762 Redbrook blast-furnace and two iron forges at Lydbrook (the latter being the birthplace of the great Richard Thomas and Baldwins Ltd. firm) were leased to Richard Reynolds, John Partridge (Senior) and John Partridge (Junior) for 21 years. During the year 1771 Messrs. Townshend and Wood erected at Lower Redbrook a tinplate works on the site sold to them by the Governor and Company of Copper Miners in England who in 1720 had taken the works on lease. This works was at one time operated by the same David Tanner who owned works at Tintern, Pontypool and Lydbrook. The Rev. Archdeacon Wm. Coxe in his "Tour Through Monmouthshire"(1801) mentioned, "About two miles from Monmouth a small stream

called Redbrook—where some iron and tin works give animation to the romantic scenery" and in an appendix he gives the shipments of tinplates from Chepstow (then a flourishing port) as follows:—

	Tons	Cwts.	Qtr.	Lbs.
1791-3		NIL		
1794	22	10	1	0
1795	27	5	2	14
1796	43	0	0	0

Another very interesting feature which emphasizes the progressive spirit of the Redbrook management which has been an outstanding aspect of this plant for very many years, was the very early installation of a Boulton and Watt steam engine to supersede the universally used water wheel drive. Drawings in the Boulton and Watt collection dated 1798 to 1799 of "Lower Redbrook Tinn Mills" shows two pairs of rolls; one drawing shows drive by waterwheel and the other by steam engine. The rolls were 14 in. diameter × 18 in. long. The steam engine drive was installed and the old waterwheel drive removed; its original site and accompanying sluice is still clearly visible at the works.

The Redbrook Tinplate Co. are mentioned in 1876 as owners of the plant which consisted of two mills producing tinplates with the Coke, "Redbrook" brand and Charcoal, "L.R.B." brand. An interesting association has been the use made by Mushet of the Redbrook plant to roll some of his test-pieces. During the early nineteenth century trading conditions were certainly not easy and the works were often idle. After being taken over by the Redbrook Company a period of much greater prosperity ensued, the Redbrook Tinplate Co. being registered in July 1883 with £13,000 capital which was subsequently increased to £43,000.

The excellence of the quality of Redbrook tinplates attracted orders from near and far and to cope with the increased demand the company purchased the Tynewydd Tinplate Works near Newport, Mon., where in 1904 the company installed the first electrically-driven hot tinplate rolling mill in the world. The company also erected a tin stamping works adjoining the Tynewydd mills at which plant during the first world war Mr. W. T. Horton evolved a new process for the internal lacquering of shells. The Tynewydd mills closed down in October 1957, but the tin stamping plant, now greatly expanded, carries on.

Closely connected with the Redbrook Company during the present century has been a very old Monmouth family named Horton. Three brothers of this family have played a very large part in the technical development and efficient operation of the company; they are Mr. W. T. Horton, managing director and general manager of the Tynewydd Works, Mr. I. Horton, general manager of the Redbrook Works and also a director of the company. Another brother, Mr. Ray Horton, a very well known engineer in East Wales, acts as engineering consultant. It is undoubtedly by the managerial skill and technical ability of these gentlemen that Redbrook attained the proud position of being the last hand mill tinplate plant to operate in Britain. An electric drive for the mills was installed and the annealing furnaces adapted for the use of oil as a fuel many years ago. The pickling machine, a notoriously heavy user of steam, was converted to operation by compressed air and now the amount of coal used at Redbrook is absolutely negligible. A speciality of the Redbrook plant is the manufacture of very thin tinplates for use in hermetically sealed containers. These thin tinplates, known in the trade as "Taggers," are rolled down to a thickness of 0.0025 in., a seemingly impossible figure for a hand mill but sheets of this thickness are a regular production feature.

On a very recent visit to the Redbrook plant the writer saw tinplates packed ready for export to Bombay, Calcutta, Colombo and records of a host of orders delivered to Finland, Sweden, Denmark, South Africa, Rhodesia, Uganda, Sudan, Greece and Egypt and other countries. One interesting record was of an order for tinplates to be delivered to Mecca, the plates to be shipped to Medina and thereon transported by camel to Mecca. The specification decreed that the packages be wrapped in canvas to prevent cutting or chafing the camels, backs during the overland journey. The tinning pots in operation at Redbrook have been adapted by the present management for the tinning of the very thin "Tagger" plates, the essential features of these pots being unique to the plant and not conforming to the generally known tinning units in comparable plants.

The adjacent Wye Valley railway serves the Redbrook plant with one train per day, passenger traffic having been discontinued for some years; it is now more than possible that the closure of Redbrook tinplate works will mean the absolute end for this line.

The combination of scenic beauty and industry as at Redbrook is rather unique in this country, the poet Gray describing the country surrounding Monmouth and the Wye as "A delight to the eye and a seat of pleasure".

The tinplate company at one period owned two hostelries in the village and still own quite large tracts of land on the Wye bank, a very commendable asset to any intending purchaser. It is to be hoped that some firm connected with the making and shaping of metals will look favourably on this most delightfully situated works and keep alive for much longer the historic association of this famous beauty spot with the metallurgical industries.

QUESTIONS AND ANSWERS IN PRESS TOOLMAKING

by

J. V. HARDING

Some Comments on the Subject of Examination Technique with Examples From the City and Guilds of London Institute's Examinations.

OUR examination systems have been, and still are, a popular subject for controversy. However, examinations are still with us and it can be argued that they do at least provide a comparison of academic performance among students, which, if considered with sufficient background information will indicate the suitability of a student for a particular sphere of activity.

Obviously the basic requirement for success in an examination is a thorough knowledge of the subject, and quite rightly the efforts of our lecturers and teachers are directed toward imparting this basic knowledge in whatever way is most appropriate to the particular subject involved. Little, if any consideration, is given to examination technique. Of course, the examination and its result are secondary considerations relative to the gaining of knowledge, but try telling this to a student whose promotion depends on whether or not he passes the examination.

The rights and wrongs of this situation are not suitable topics for discussion here, but by way of introduction to the answering of problems in press-tool making we may consider the students' approach (to the examination problem) and see if a little forethought will help him.

Assuming adequate knowledge of the subject it may be generally stated that the student will have two basic obstacles to overcome. One will be his own mental state. The examination is usually the culmination of several months' work and many things may depend on the result, hence it is not surprising that a nervous state of mind persists before and during the actual examination. This is not conducive to clear thinking and has many times resulted in the complete failure of a student whose work prior to the examination was completely satisfactory.

Advice on this particular problem is unending and varies between the extremes of tranquilizers and lucky charms. It has been stated that the mental condition is something that only the individual can overcome. This is largely true and an important factor in achieving a relaxed mental approach to examinations is a good physical condition, brought about by adequate nourishment and sound sleep at all times and particularly prior to the examination.

A second problem is the time factor. All students are familiar with the following or similar instructions—answer five questions only, time allowed three hours—the rapid calculation to determine the time per question, the marking of the five easier questions and then the frantic scribbling and sketching to record as much as possible in the given time, followed by the relief and the thought of another one over at least until next year.

If we accept these as two basic problems then we may say that the solution to both is largely in the students' own hands. The first has certain obvious remedies as discussed earlier. The second problem can be reduced by taking time to first read all the questions very carefully and make sure that the requirements of each are fully understood. Then deciding which of the questions can be answered adequately and well and going to it.

These are very general statements and so obvious that there appears to be little merit in repeating them. However, most examiners will agree that from a perusal of any group of examination papers the problems are very real to most students and the obvious and simple remedies are frequently ignored.

Let us consider certain more specific faults and see how they can be avoided or at least reduced.

Misinterpretation

A factor that accounts for a very large proportion of the failures in examinations is the misinterpretation of the question by the student, and it cannot be stressed too highly that time must be spent in reading and thoroughly understanding the question before it is attempted. Questions are not phrased to "catch" the student, and with a reasonable command of the English language and with careful reading, the meaning and the requirements of any question should become clear.

Consider the question below which was set in a recent National Certificate Examination:

"*Describe two methods of selective surface hardening and give the material specification in each method you describe*".

Out of 100 students attempting this question, 70 missed the word "selective" and plunged straight into descriptions of the available surface-hardening methods making no reference to the methods used to obtain a locally hard region where required. It can be stated with certainty that in ignoring the methods of obtaining locally hard surfaces, the question has not been answered. However, an examiner can justifiably accord a proportion of the marks for a description of the surface-hardening methods as this is obviously a necessary part of the answer. But, marks have been lost for what was in all probability a careless "first reading" of the question.

This clearly emphasizes the need for a careful study of each question and a thorough understanding of exactly what is required by the examiner.

Clear Thinking and Expression

Marks can be lost in descriptive questions if the student is not able to express his thoughts clearly. Clear thinking must come before clear expression by the written word. A student who rushes his first thoughts down on to the paper, may easily, by bad expression, convey a completely wrong impression of his knowledge of the particular subject.

Consider this sentence:

"Clearance in bottom shoe now also for pilots has dirt or if a lubricant was used they would get filled up and impair the pilots".

This is a student's answer to a question asking why through clearance in the bottom shoe of a press tool is necessary for the pilot punch holes. When this type of answer can be interpreted against a specific question it is reasonably easy to assess the student's knowledge. In this case, he obviously knows that a blind pilot hole can become flooded with lubricant, choked with swarf and dirt and possibly cause damage to the pilot. We may assume a little further thought on the student's part would suggest to him that in high-speed press work with the possibility of "slug lift", slugs may find their way into the pilot hole.

However, this muddled expression used in a generally descriptive question may be very difficult if not impossible to understand and result in a serious loss of marks. If his command of the language and power of expression is poor, a student should confine himself to answers in list form. For example the question considered could be answered thus, using the same words but not strung together:

Clearance through the pilot holes in the bottom shoe of a press tool is required because—

Any obstruction to the passage of the pilot may damage the pilot or the die.

If pilot holes do not have through clearance an obstruction may be caused because: (i) oil; (ii) dirt; (iii) swarf; (iv) slugs; may enter and fill the hole.

Layout and Method

Questions that involve calculation and the use of certain appropriate formulae are frequently the cause of marks being lost unnecessarily.

Consider the following question:

"*Calculate the capacity of the power press required to blank an aperture of 1 inch diameter in $\frac{1}{16}$-in. mild-steel sheet. Assume the ultimate shear stress of the material is 20 tons per sq. inch*".

Answer:
$$3\tfrac{1}{2} \times \tfrac{1}{16} \times 20 =$$
$$\frac{11}{56} \times 20 =$$
$$\frac{201}{56} = 3.6 \text{ tons.}$$

The answer is wrong and very few marks can be allocated for method. In actual fact it is relatively easy to see where the arithmetical slip has occurred and that the student is aware of the method of calculation. However, with a very simple revision to the layout the student can make it absolutely clear that he has a good grasp of the method *e.g.*

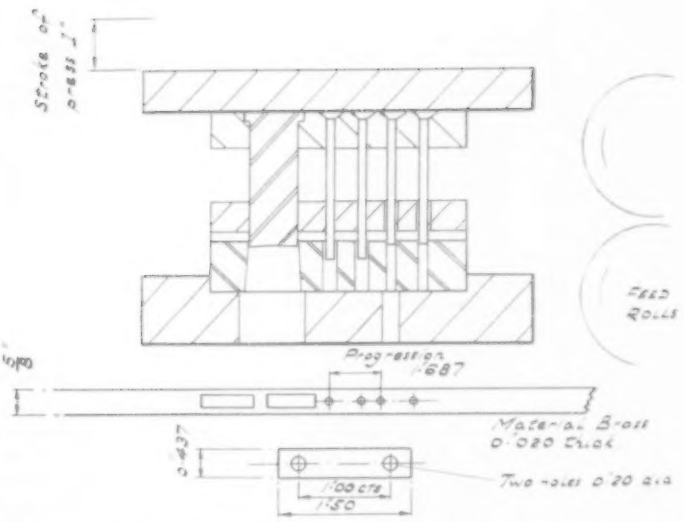
Thickness of material $\frac{1}{16}$ in. (0.062 in.)
Diameter to be blanked 1 in.
$\therefore$ Area of blanking = circumference of blank × thickness of material.
$$= \frac{22}{7} \times 1 \times \frac{1}{16} \text{ sq. in.}$$
$$= \frac{11}{56} \text{ sq in.}$$
U.T.S. of material = 20 tons per sq. inch.
$\therefore$ Tonnage required
$$= \frac{11}{56} \times 20 \text{ tons}$$
$$= 3.97 \text{ tons.}$$

This is a simple example but it will be readily understood that in a more complex question it will be extremely difficult if not impossible to follow a student's reasoning if the working is not laid out clearly stage by stage. In this event and with an incorrect answer, the marks allocated will be very low. In taking the trouble to lay out a question clearly, there is less chance of making a silly error and also an examiner will invariably be sympathetic towards arithmetical slips, if relevant formulae are quoted and used in the correct manner.

To summarize, we may say that these ideas are by no means new but they should be well considered, and practised by all students. A year's work can be wasted in a few hours if the power to communicate it is not developed.

The experience of most examiners shows that a large proportion of examination answers are characterized by limited powers of expression and a

Fig. 1



poor command of the English language. This is all too frequently coupled with an inability to manipulate simple arithmetical problems. A certain amount of this trouble can be attributed to examination nerves, but not all, and there is a certain irony in a situation where we are teaching specialist subjects to young engineers who have not the elementary knowledge to exploit the advanced work they so hopefully absorb. Perhaps there is some justification for a re-examination of the newer teaching methods used in our elementary schools, that we may satisfy ourselves that we really have improved on the older and well tried methods.

The following questions and answers in press-tool making are reproduced by kind permission of the City and Guilds of London Institute. The answers do not necessarily represent the official views of the Institute.

QUESTION 1.

The press tool, together with strip layout shown in Fig. 1 is of very poor design.

(*a*) *Enumerate and explain the faults.*

(*b*) *Give freehand sketches in good proportion with descriptive notes of the redesigned features that you would recommend.*

Preliminary Considerations

This question is essentially practical and has the added advantage that it can be answered almost completely in list form and with explanatory sketches. There is some danger here however, in that there is a possibility of confusing the answers to the two parts, and this must be avoided by treating the question as two separate parts and answering them accordingly. Basically the first part requires a list of faults with a brief explanation of each one, and the second part, suggested improvements. The answer can, and should, go a stage further than suggesting improvements to the poor design features. The complete tool is of an unsatisfactory design and the answer should include a suggestion for an improved design.

Answer (a)

i. The long slender punches are not guided in the stripper and hence are liable to excessive breakages.

ii. Slug clearance is not provided in the shoe or base of the tool, for one of the punches. This will result in a blocked die and breakage of the punch and possibly die damage.

iii. There is no clearance in the shoe beneath the guide holes for the location pins. These holes may become blocked with swarf, dirt and possibly slugs if slug lift is taking place, and eventually cause damage to the locating pins and the die.

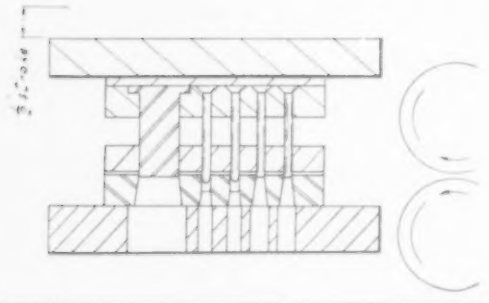
iv. The locating pins are a clearance fit in the die. Better support is provided if they are a run fit in the die.

v. The locating pins are flat bottomed and a very slight misalignment between the pins and the locating hole in the strip will prevent the pins from entering the holes and locating the strip.

vi. The locating pins appear to penetrate too far into the die. Long penetration is unnecessary and may interfere with the feeding of the strip.

vii. The main punch has shear on the base. This would almost certainly be unnecessary for 0.020-in. thick material and if it was necessary it should be on the die to prevent distortion of the part.

viii. The stroke of the press appears to allow the the punches completely to withdraw from the stripper plate. Even though this tool would



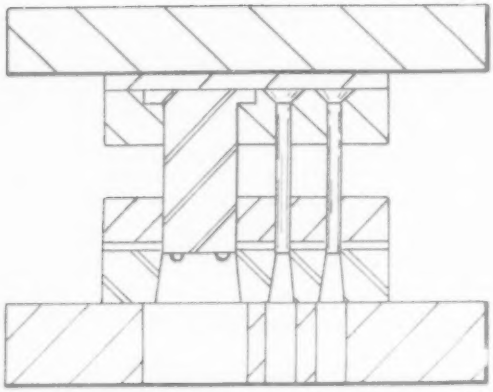


Fig. 2 (above)
Fig. 3 (right)

obviously be mounted on a die set it is not advisable to let long slender punches withdraw in this way.

ix. All the punches and the location pins are unnecessarily long and therefore more liable to breakage.

x. The tool and the component are light and it is not necessary to let the die into the shoe.

xi. The feed rolls are not in line with the strip feed opening.

xii. The feed rolls are rotating in the wrong direction.

xiii. The progression figure given is too high, as it allows for a $\frac{3}{16}$ in. scrap webbing between parts.

xiv. The tool does not indicate a hardened backing plate for the punches and this may result in a hammering of the top plate and eventual loosening of the small punches.

xv. As shown, the clearance between stripper plate and die is very large and would allow the strip to buckle if it was obstructed in any way.

Answer (b)

The corresponding redesigned features on the existing tool would be as follows:

i. The small punches to be a good run fit in the stripper plate.

ii & iii. Provide slug clearance in the shoes.

iv. Location pins to be a run fit in the die.

v. Provide the conventional acorn shaped lead in to the location pins.

vi. Reduce pin length.

vii. Eliminate the shear.

viii. Reduce the stroke of the press.

ix. Reduce punch and pin length.

x. The punch could sit on a plain shoe.

xi. Line up feed rolls and die aperture.

xii. Reverse direction of rotation of feed rolls.

xiii. Reduce the progression figure to 1.562 in. This reduces scrap and yields more parts per coil or strip.

xiv. Position a backing plate behind the small punches. Hammering of cast-iron top plates is a common fault particularly with small punches (although it is unlikely on a light job). A recess can be formed in the plate and this results in the punch becoming loose and increases the risk of breakage.

xv. Reduce the clearance between stripper plate and die thereby preventing the possibility of the strip buckling.

By simply redesigning or modifying the bad features on the existing tool it appears as in Fig. 2. However, the general design is poor and could be simplified by a complete redesign as shown in Fig. 3, *i.e.* three stages are unnecessary with this simple component. The location pins can be integral with the main punch thereby eliminating the second and locating stage.

An even simpler tool suitable for hand feeding is shown in Fig. 4. This would involve feeding a 1.5-in. wide strip and punching the two holes side by side. A solid back stop and a shearing punch provide for cropping off at 0.437 in. wide.

* * *

An answer on similar lines to these shows a good appreciation of basic press tool practice. A good

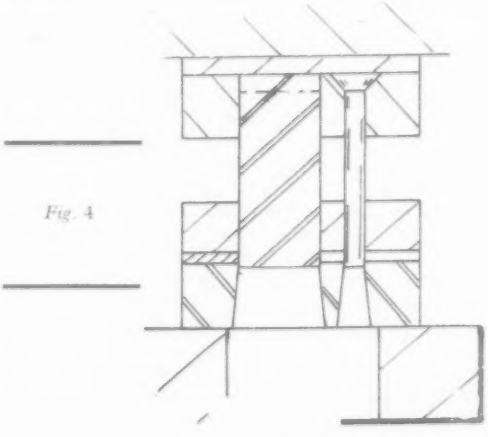


Fig. 4

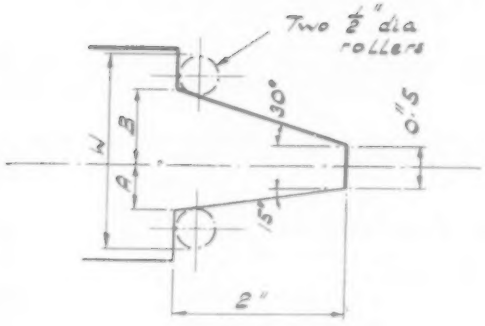


Fig. 5

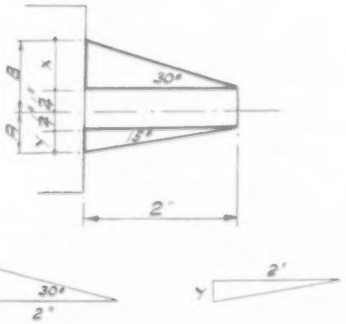
range of faults with explanations has been compiled and in the second part sound remedies have been put forward. This has been followed up with a suggestion for a complete redesign which reduces tool costs and fulfils the requirements. Finally as an afterthought a simple pierce and crop tool is offered for hand feeding. In short, a reasonable and complete answer to the question.

QUESTION 2.

A wedge cam is shown in Figure 5. *Calculate the dimensions A and B.*

In checking the taper a measurement W is taken over two ½-in. dia. rollers. Calculate the dimension W.

Fig. 6



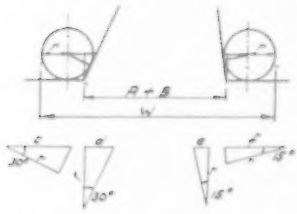
From the triangles

$\frac{x}{2} = \tan 30° \quad x = 2 \tan 30° = 2 \times 0{\cdot}5773 = 1{\cdot}1546$

$\frac{y}{2} = \tan 15° \quad y = 2 \tan 15° = 2 \times 0{\cdot}2679 = 0{\cdot}5358$

$\therefore B = x + 0{\cdot}25 = 1{\cdot}4046$

$A = y + 0{\cdot}25 = 0{\cdot}7858$



$W = A + B + 2c + 2e + d + f$

From the triangles

$\cos 30 = \frac{·25}{c} \quad \therefore c = \frac{·25}{·866} = 0{\cdot}2886$

$\tan 30 = \frac{d}{·25} \quad \therefore d = ·25 \times ·5773 = 0{\cdot}1443$

$\tan 15 = \frac{e}{·25} \quad \therefore e = ·25 \times ·2679 = 0{\cdot}0669$

$\cos 15 = \frac{·25}{f} \quad \therefore f = \frac{·25}{·9659} = 0{\cdot}2588$

$\therefore W = 1{\cdot}4046 + ·7858 + ·5 + ·2886 + ·2588 + ·1443 + ·0669$

$W = 3{\cdot}4488$

Fig. 7

Preliminary Considerations

This question is a straight-forward calculation involving a knowledge of the trigonometrical ratios. Consider the first part. This is best treated in a similar way to that shown in Fig. 6. A sketch of the cam is made and the individual dimensions that make up the required dimensions A and B are marked. This clearly shows the two unknown dimensions as the sides of two triangles and they can be readily calculated.

The layout is simple and it shows clearly the method used. Any arithmetical slips could be found easily. An assumption has been made in that the 0.5 in. dimension is assumed to be equi-spaced about the centre line.

The second part is a little more involved and again a sketch of the cam is made, but this time with the rollers in position. Now the individual dimensions making up the dimension *W* can be seen clearly. Four triangles need to be solved and it is immediately clear that the values *d* and *e* must be subtracted from the total (Fig. 7).

The calculations are laid out clearly and the ratios that are used are given. Arithmetical slips would be quickly detected. The working, using logarithms or longhand, would of course be shown, but it should be kept clear of the actual layout.

Notice how both questions are simplified by repeating the appropriate part of the diagram and breaking down the dimensions required into individual parts. The appropriate triangles can then be readily seen and there is less chance of an error in method or arithmetic.

THE INTERNATIONAL RESEARCH ASSOCIATION FOR MECHANICAL PRODUCTION ENGINEERING (C.I.R.P.)

A Review of Its Aims, Objects and Operating Methods

By Prof. Dr.-Ing O. KIENZLE

EVEN without formal organization, the scientists of the world are engaged in an invisible collaboration and co-operative effort, in that they reciprocally take notice of each other's publications. Letters and papers, in each case dealing with the next step forward, lead to an interchange of ideas between persons who never see each other face to face. This form of communication has, however, two disadvantages: first, it is not always easy to discover the periodicals, transactions or proceedings in which the scientific partner is publishing his results; second, measured by modern needs, the pace of this interchange of ideas is too slow.

Consequently, the number of international scientific organizations and the frequency of their meetings and conferences is multiplying to a sometimes frightening degree. Only rational working methods can help here. In this case again, the rule applies that the result must justify the means. The author proposes, therefore, to describe the organization of the work of the C.I.R.P. from this aspect.

That the members of the Association meet annually for a whole week, for discussions at conferences and the inspection of laboratories and production plants in the host country may be interpreted to mean that they are themselves satisfied with these arrangements. In these meetings, the first of which took place in Paris in 1951, 15 to 25 papers on production engineering problems are usually presented, the majority of which have been previously submitted and can therefore be actively discussed. These are now available in seven volumes of "Proceedings" which have been collected from preprints in the Swiss journal *Microtecnic*.

If it is considered that only ten years ago members knew practically nothing of each other's labours, this represents a high rate of progress, since nowadays, each member is personally acquainted with colleagues in 17 other countries, and knows their views and intentions. It is even more important that visits are made to each other's laboratories and members now write to each other to obtain any information they may desire.

The outline of the matters which are dealt with in exploring the problems of production engineering has, after several years of co-operative association, become crystallized in a definitive form. Main concern is with the following classes of production methods for solid bodies, *i.e.*, for machinery parts and equipment components :

1. *Machining:* Turning, planing, broaching, milling, grinding, etc; physical and chemical methods of removing material.

2. *Cutting:* Shearing of sheets, plates, billets, wires, etc.

3. (*Non-cutting*) *Shaping:* Forging, stamping, extrusion, wire-drawing, bending, deep-drawing, etc. ;

4. *Joining:* Bolting, press-fitting, shrinking, joining by shaping, *e.g.*, riveting, beading, etc.

While these processes principally concern metals, the working of wood, and also any further solid substances, can always be brought into consideration. A schedule of this kind is also interesting by what it omits.

The processes of casting, sintering, plastics moulding, welding, brazing and cementing, as well as heat-treatment and surface-finishing, are not considered by the present Association as belonging to their proper sphere of action, since other international organizations are already working on these problems.

It is *only when* these processes involve purely production problems as such—manufacturing accuracy, assembly rhythm (time and motion study) or automation, and *if* these are not being dealt with by the other organizations involved—possibly because they are only interested in the technology of the process as such—that the C.I.R.P. are interested in dealing with individual tasks in these fields; it is a known fact that experiences in one production field can often be usefully applied at

little cost and with great success in some other field.

The different production techniques very frequently approach each other more closely than is commonly thought—for instance, the technique of mould-making for pressure casting and plastics moulding is practically the same as that for making forging dies.

It must further be pointed out that the sphere of the Association's activities does not embrace the structural design and development of machine tools and tooling equipment; these matters are dealt with directly between users and makers and between these firms and the research organizations in the individual countries; the activity and the success of this development work has been vividly brought to notice by the successive Machine Tool Exhibitions in Europe. The Association does, of course, deal with tooling problems when it is a question of applying new production methods, of verifying their accuracy, of investigating their suitability for applying automation technique, or of their adaptation to the human factor; but the actual structural design development is not considered.

Similarly, problems of plant layout are not considered, since these require the services of experts in conveyor techniques, power engineers, heating, ventilation and lighting specialists and structural engineers and builders.

Each of the above-mentioned production techniques is investigated in its different aspects, which are common to all of them. *Basic research* is, of course, the beginning; then followed by the investigation of the:

(*a*) Influence of the method on the material characteristics of the product;
(*b*) Possible geometrical forms and shapes;
(*c*) Interchangeability and surface quality;
(*d*) Quantitative performance (productivity);
(*e*) Automation;
(*f*) Adaptation of the production cycle to the human element;
(*g*) Production economy.

While basic research is fundamentally a scientific activity, the last-mentioned of the above points indicates the ultimate purpose of the activities, for which the interests of the several national economies are the guiding factors.

It is, unfortunately, not possible to claim that the four process classes, or the seven processing aspects, are all given equal care and attention. Even within the individual groups or classes, published papers tend to concentrate interest on individual processes; in machining, on lathe work, in non-cutting shaping, on deep-drawing. Shearing and joining techniques have hardly progressed beyond the stage of an exchange of views and ideas.

There is, in the author's opinion, however, already an advantage of inestimable value in the mere fact that the C.I.R.P. have classed these problems on the same level. However important machining may be for the shaping of large workpieces, there is hardly any process of working sheet-metal, wire, extrusions or the shaping of billets which does not involve some form of cutting operation, which is worthy of being investigated and followed up not only because of the required accuracy and finish of the work but because of its millionfold repetition and the consequential wear of tools and equipment. Joining processes, also called assembly, or fitting, have hitherto quite wrongly been regarded as of secondary importance although, in precision mechanics or in aircraft construction, they often absorb more than half of the expended time and labour. Their fundamental analysis and investigation often furnishes fresh impulses to the development of interchangeability and automation, and even influence the constructional shaping of the product.

The Association has, consequently, in its own ranks imposed the requirement that fabrication problems which, in the general case, particularly in regard to quality and output, are of *equal importance*, should in principle be treated as *equally-ranking research assignments*.

This does not mean that there is a refusal to give special attention to problems of urgency; it is, in fact, a feature of the research activities that separate working parties are formed for such special tasks.

Such problems include, for instance, the study of surface finishes. Definitions and metrological methods have been under study for some years by a working party under the guidance of Prof. Dr.-Ing. Bickel, of Switzerland. This brings up the question of international standards; development of tentative standards is left to the ISO, but insofar as production problems are involved, the C.I.R.P. consider this a priority assignment. In application to surface study, it involves, among other questions, the assessment of testing methods, the development of production standards for test gauges and testing equipment, etc.

A further working party was set up in 1958 for consideration of machinability standards for different methods. Led by Prof. Dr.-Ing. Opitz (German Federal Republic), this group has held very fruitful discussions in Aachen. The activities of these working parties are reported at annual meetings by the group leaders.

Such reports can be particularly important, since they do not reflect the views of a single research worker, but are the common expression of the views of leading, industrial scientists and consequently represent the present state of the art in any problem of production or fabrication. When the highest level of the art is presented as the sum of all the peak performances attained hitherto, enlightenment is brought to all those who have not yet attained that level, and an encouragement and a stimulus given to

them, to initiate similar researches and industrial tests in their own countries. An endeavour is always made, therefore, particularly in the less well-cultivated fields of such research, to encourage even individual members to survey the general problem of any particular production or fabrication method or technique, and to report their results to us; in this regard, regular correspondence with members of the C.I.R.P. could be a great help.

The overall survey of the conditions in 17 different countries, however, not only shows what peak performances have been attained, but also what low standards still persist, and where the gaps in the research programmes are still to be found. Some examples of the many problems as yet unsolved, are:

Workshop testing of bevel gears, worms and worm wheels.

Determination of suitable material allowances for cast and forged blanks, enabling them to be finished in a *single* operation.

Sheet-metal shaping by explosion pressures.

Protection of workers against heat, fumes and noise.

It may be imagined what it means when a conclave of highly-experienced specialists in mechanical production methods thus throws some 10 to 20 problems, all marked " Urgent Priority " into your lap! Since in every country, any research worker is apt to be faced with a multitude of problems, he will be the more inclined to turn to those which the C.I.R.P. have designated as of highest priority. He will further benefit from the fact that he will be informed of the country in which he will find the best basis, from which to start his investigation; a recommendation from the C.I.R.P. will also aid those organizations which have to allocate research resources to come to a decision on the merits of any individual case.

The question: " Who is working, where, on what ? " is of interest to every research worker, to every branch of industry. The Association are, therefore, compiling a record of such activities, for which it is hoped to get the information from colleagues in all countries. This survey of production engineering researches and research facilities, currently kept up to date, should be of great help to everybody.

It is not intended, however, to domineer in any way, as the C.I.R.P. are quite content to let everyone, within the scope and requirements of the particular country, conduct such researches as may be opportune. In the author's view, the natural trend of events in the development of any problem will lead to abstention from individual research in matters which are already engaging the attention of anything from six to ten other research laboratories. Indeed, the tendency will be to attack problems which have hitherto been somewhat neglected; in fact, to break new ground, in a properly scientific research.

Two more points of practical interest should be mentioned. Work has started and is well under way on an international, technical glossary, at first in the three languages, German, English and French, containing scientific and technical terms, with their definitions, assisted by suitable drawings. This is intended to be published in separate, successive numbers.

The second, practical point should be of particular interest to industrial circles generally. It is proposed, wherever opportunity offers, to establish the extent to which the results of scientific and technological research, obtained within the scope of the Association's activities or elsewhere, have found practical application, since it is that which crowns its labours.

It is hoped that a general picture of the working methods and organization of the C.I.R.P. has been given. This, however, like any other organization, can only be sustained and borne forward by high ideals and rigid standards. The author would, therefore, like to say a few words about the principles whereby the Association are guided.

Humanity has now become so closely-knit that any happening in any land has immediate repercussions in and on any other country. We see now more clearly than ever before what, on this Earth, needs and is capable of improvement, in order that all men may live and exist free from want and hunger. For this we need, in addition to intellectual fare, food, clothing, housing and means of transport. Their provision is the task of the production engineer.

Any goods, products or manufactures are, of course, created in three ways:

By mental effort or research;

By designing in prototype or in graphical form;

By production method.

For centuries, the production aspect has been in the hands of master craftsmen and tradesmen alone and did not appear to call for any intervention by the scientist.

The ethical requirement, however, of supplying more people with more and better consumer goods makes it essential to consider how the task can be performed better and more quickly. That is, however, at the same time, a challenge to Science.

To-day there is a " Science of Production." In the colleges of all countries, research is beginning, on production methods, production aids; and this research is now on an equal footing with the researches which in the past, in mechanical engineering, for instance, have been devoted to the problem of the prime mover—the source of power. Where would we be to-day, for instance, in the development of mechanical traction or refrigeration

(*Continued in page* 919)

THE HIGH-SPEED PRODUCTION OF REFRIGERATOR CABINETS

Details of two typical manufacturing methods in use in the United States.

COMPETITION in the refrigerator industry is very fierce in the United States, just as it recently became in this country. It is not surprising, therefore, that American manufacturers of home refrigeration units make the maximum use of mechanized sheet-metal forming methods and of high-speed automatic electric welding machines in order to keep production cost down. Two typical manufacturing methods will be described in the following text.

Automated Fabrication Line

Up to 180 refrigeration cabinets per hour are produced by the automated production line in use at an American plant (Fig. 1). Three more similar lines are in operation in this large factory to meet production requirements.

The line starts with a sheet destacker. Here the low-carbon steel sheets on trolleys are moved into position. The automatic transfer features of the production line then move the sheet through all of the successive operations. At the unloading station the finished refrigeration cabinet is put on a conveyor. It is then carried on through further processing operations.

In addition to sheet punching, notching, forming and bending, there is a total of 148 different welds on each cabinet (Fig. 1). These consist of 20 spot-tack welds at the tangent bending station; 20 spot welds on the back to bottom welder; 2 seam welds, 2 line-projection welds, 8 spot welds and 8 dimple-projection welds at the corner and toe welder; 88 spot welds are used at the back welder station.

All of these operations are electrically co-ordinated. A combination of timers and limit switches control flow of the product. Each machine in the line has individual controls for pre-set and adjustment. The lines handle five different sizes of

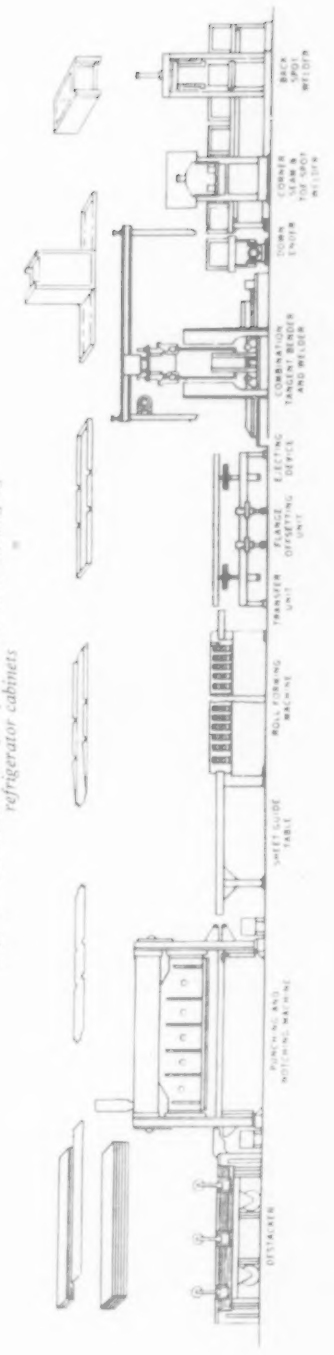
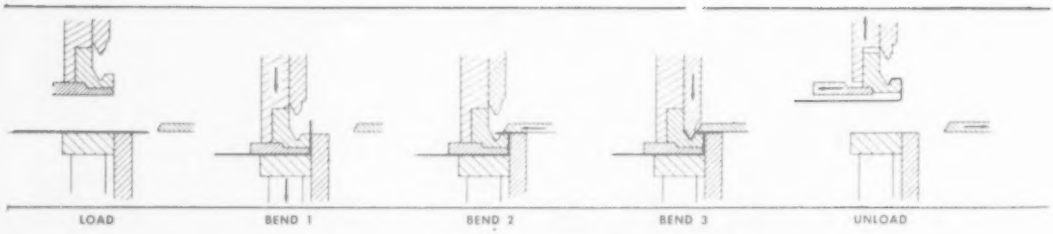


Fig. 1.—Automated line for fabrication and welding of refrigerator cabinets



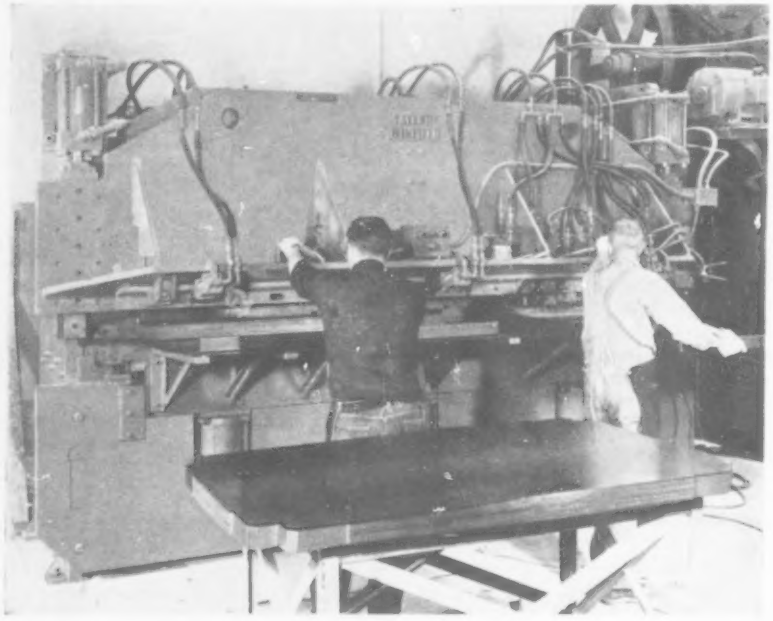


Fig. 2 (above).—Sequence of high-speed multiple bender operations

Fig. 3 (left).—Hydraulically-operated three-slide refrigerator door forming machine. One side and one end of the door are formed simultaneously

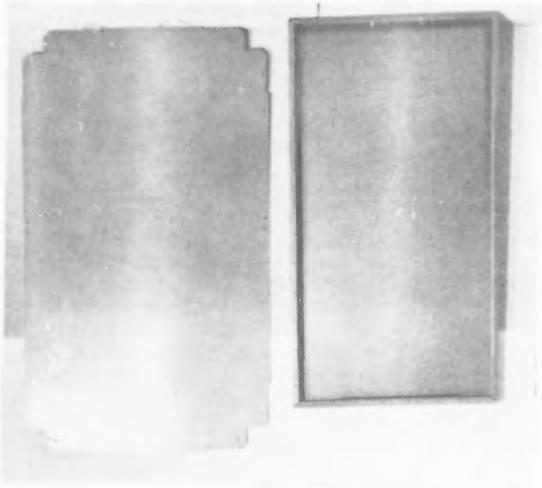
Fig. 4. (below), (left).—Sheet is blanked, punched and notched prior to bending; (right) Door with edges formed

refrigeration cabinets and the sheets are 0.035 in. thick by 26 in. wide. Sheet length varies with the size of the cabinet.

Sheet Flow Operations

The destacker (Fig. 1) operates with an arrangement of vacuum cups, air jets and magnetic rolls. This starts the sheets on their way to the punching and notching machine, using a blanking die. Rollers retract on the down-stroke of the machine. Next comes a sheet guide table and from here the sheets are moved into the roll-forming machine. A transfer unit (*see* Fig. 1) is followed by a flange offsetting machine with ejecting device. The corner flanges have been offset in order to prevent interference during the following bending operation. A combination tangent bender and welder provides spot welding of the cabinet bottom and back. The bottom and back unit is lifted into position before the main sheet is bent on the tangent bender. Then the sides of the cabinet are

(*Continued in page* 919)



Determination of the DEEP-DRAWING CAPACITY OF LIGHT SHEET METAL ON THE BASIS OF LABORATORY TESTS*

and the Development of a Drawn Prototype Representing Car-Body Panels

By M. JENTET†

AN earlier investigation (1954) had established the correlation between various conventional tests and the results obtained in the deep-drawing of a cup, using as a characteristic the maximum blank diameter which can be drawn without tearing (critical diameter).

These tests showed that by improving the tooling so as to facilitate metal flow, the deep-drawing capacity of a blank of given diameter becomes more independent of the conventional characteristics of the sheet-metal used.

This law was only demonstrated in the case investigated, i.e. with a very simple drawn part, for which the technological conditions of the test might be more important than the actual form of the part, and such conditions do not obtain in the case of car-body stampings.

It is for this reason that a more complicated drawn part has been used by the author while still retaining a form which lends itself to rigorous evaluation of the results obtained.

As in the work cited above, the conventional characteristics have been compared with the critical diameters given by this new type of drawn part, and the laws of correlation have been established.

The results have also been compared with those obtained with cylindrical shells having flat or hemispherical bottoms, in order to relate these new results with the earlier investigation and the resulting laws have been developed.

I—GENERAL PLAN

IN 1954, an investigation was undertaken of the value of various criteria generally applied for the acceptance testing of deep-drawing sheets.

Selected as a prototype was a drawn cup of the Swift type, made in an industrial press, *i.e.* at a speed employed in practical manufacture. The diameter of the largest blank which could be successfully deep-drawn represented the deep-drawing capacity of the sheet metal, and this is called the critical diameter which is denoted by ϕc in the following paper.

The possibility was thus offered of comparing each criterion with the corresponding ϕc and thus estimating its value as a characteristic of the sheet metal.

During this work, the typical tooling was modified in a manner which was considered to increase the selectivity of the tests.

This did not prove to be the case, however, and the results obtained allowed the formulation of the following law :

The more the tooling is improved so as to facilitate metal flow—an improvement measured in terms of the increased ϕc obtained, other things being equal—the less correlation is to be observed between the conventional criteria and the formability of the sheet metal.

This law may well have been valid only in the case investigated, *i.e.*, with a very simple drawn part for which the technological conditions of the test might be more important than the actual shape of the part.

Such conditions do not generally obtain, however, in the case of car-body stampings.

It is for this reason that the author attempted to use a more complex drawn part while still retaining a form which lent itself to rigorous evaluation of the results obtained.

After various tests, it was decided that it would be advantageous to use a punch, the symmetrical elements of which are restricted to two perpendicular planes : a part of a cylinder recut by another cylinder.

The stress field in such a drawn part should then contain tangential stresses relatively more intense than those obtaining in shapes of revolution.

In a preliminary investigation in which the dimensions of the punch were varied, an attempt was made to obtain fractures of a shear type, *i.e.* under the predominating effect of a tangential stress.

After this, tests similar to those made in 1954 were carried out.

* A paper presented to the Paris Meeting of the International Deep Drawing Research Group and the Société Française de Métallurgie.

† Directeur des Contrôles Techniques, Sté. des Usines Chausson.

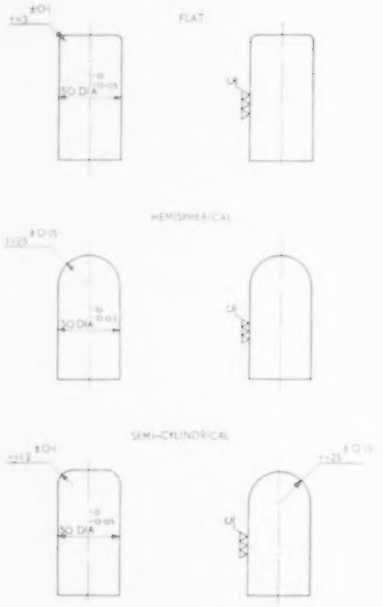


Fig. 1.—Form of the punches

The following relates to the two investigations in conjunction (which will be briefly denoted as Investigation 54 and Investigation 59); it reports the essential data and tabulates the results.

II—TECHNOLOGICAL CHARACTERISTICS OF INVESTIGATIONS 54 and 59

(a) Type of Shell Selected—General Form

In all cases, this is a cylindrical cup of internal diameter 50 mm.

The shape of the bottom varies.

Investigation 54 : The bottom is flat and joined by an inner radius of 5 mm.

Investigation 59 : After the exploratory tests described above, the form adopted was that of a cylinder with an axis perpendicular to that of the drawn part.

For comparison purposes, flat and hemispherical bases were also tried.

Fig. 1 shows the punches used for this purpose.

(b) Materials Tested

These are car-body stampings in accordance with document UTAC 1008.

Thickness	*Type of Sheet*
Investigation 54, 1 mm. Investigation 59, 0.9 mm.	The 4 high-grade categories (O, M, P, S) were used and the two aspects X and Z.

Following the industrial trends, we favoured lighter sheets in 59 than in 54. Investigations are, moreover, in progress, with sheets of 7 mm. thick.

The surface finish of the sheets used was characterised by an Ra value of 1 to 2 (measured using a Perthometer with a cut-off of 0.75).

(c) Tooling

Dual-purpose tooling, in accordance with Fig. 2, was used.

Lubrication : Investigation 54 : Ricyl No. 171 oil
Investigation 59 : Oleotechnique oil No. 459.

These lubricants are currently used in deep drawing and tests have shown that, in the experimental conditions, they are virtually equal to other laboratory products (technical grade stearic acid, for instance.)

(d) Machine Used

A 40-ton mechanical press with a single-action gear, equipped with a pneumatic blank-holder.

With the tooling described above, the speeds obtained for the whole of the work were :

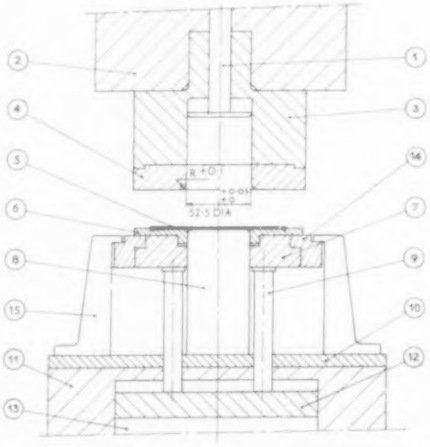
on starting : 20 m. per min.
at the end of the operation : 7.5 m. per min.

The total thrust of the blank-holder was 2,400 kg, *i.e.* about 50 kg. per sq. cm. of the blank.

The overall variation never exceeded ± 5 per cent.

These criteria have been used, either directly, or compared with one another (E/R).

Fig. 2.—1. *Ejector*
2. *Crosshead*
3. *Die-holder*
4. *Die*
5. *Blank to be drawn*
6. *Die ring*
7. *Die ring holder*
8. *Punch*
9. *Die ring support*
10. *Tool foot*
11. *Press table*
12. *Die ring plunger*
13. *Press cylinder*
14. *Stop*
15. *Flange ring*



(*c*) *Acceptance Criteria Measured on the Sheets and the Measuring Conditions*

Criterion	Investigation 54	Investigation 59
A per cent	In accordance with N.F.A.03.101	In accordance with Euronorm 11.55.
Am per cent	The principal difference is to be found in the dimensions of the test-piece which are	
R		
E	breadth 30 distance between ref. points : variable	breadth 20 distance between ref. points : 80
HR_B	In accordance with N.F.A.03.103	
IE	In accordance with N.F.A.03.602	
d per cent KWI	Deduced from the KWI test	
	d per cent = circumferential elongation at the instant of fracture	
μ"KWI	$\mu'' = \frac{d \text{ per cent}}{\text{maximum load}}$	
n, grain-size	in accordance with ASTM specification	
λ, length of the stretch of the flow	measured on the diagram prepared on the 10-ton, hydraulic pendulum AMSLER machine.	

Where several criteria were interlinked by a constant relationship (for instance, Am per cent and A per cent), only the most representative was retained, or the one the most easily measured.

All this has required supplementary investigations which are not reported here.

SECTION III—TEST PROCEDURE

(*a*) *Measuring the criteria*

Each measured criterion is the mean of 10 tests.

(*b*) *Measuring* Φc

This is defined as follows :

Φc is attained when the breakage incidence over 10 blanks is at most one component and an increase in the diameter of a few tenths of a millimeter produces a higher breakage incidence.

(*c*) *Development of the tooling*

1. Investigation 54 :

This covered two series of tests :

Series No. 1 : The radius of the die had not been rationally determined. Φc varied from 95 to 101.

Series No. 2 : After the radius of the die (finally 5 mm.) had been the subject of investigation and the running of the tool improved.

2. Investigation 59 :

This started with a search for a punch which would make the form of the drawn part a predominant factor with reference to the technological conditions of the test.

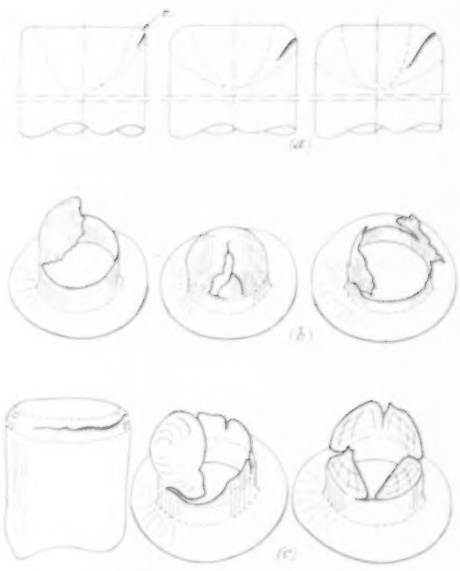


Fig. 3.—Study of the semi-cylindrical punch

(*a*) *Development of the start of fracture as a function of the radius* r

(*b*) *Fracture forms with* r = 12 *mm.*

(*c*) *Fracture obtained with flat and hemispherical punches*

The conditions to be obtained were :

(1) that the stress field of the drawn part selected has tangential stresses which are higher than those obtaining in simple forms of revolution.

(2) that the fractures do not start at the junctions of the radii and the body of the punch.

(3) that the " critical dimension " of the blank is well defined and easily measured. (In fact, it was not apparent that a circular blank could be retained, a result which fortunately was attained).

Final choice was a cylindrical punch terminating in a surface, also cylindrical, of the same radius, with an axis perpendicular to the former and joined by radii which required to be determined (Fig. 3).

If *r* is small (4 mm.), the fractures occur at the junction of this radius with the cylindrical body, as in the case of a punch with a flat head.

If *r* attains a value $\frac{D}{2}$, the hemispherical punch is being approached. This value must therefore be eliminated.

It was with $r = 12$ that the least localized fractures were obtained, of less attenuated shapes, indicating shear stresses.

The figure shows at (*a*) the development of the start of the fracture and at (*b*) the diversity of fractures obtained with the radius 12 mm.

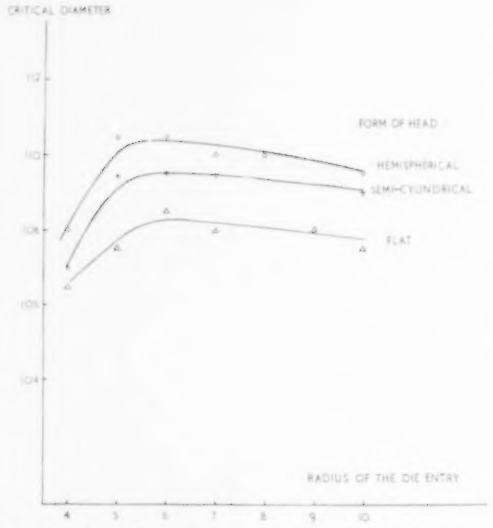


Fig. 4.—Critical diameter as a function of the radius of the die entry for three forms of punch (thickness 0.9 mm.)

As a reminder, (*c*) shows the fractures produced by flat and hemispherical punches.

Investigation of the Radius of the Die

Investigation 54 having shown the preponderating influence of the radius of the die, a systematic determination was undertaken.

For this, a very large number of tests were made, with sheets of different thicknesses and for three forms of punch :

flat
hemispherical
semi-cylindrical.

The results are summarized by the curves :

Fig. 4 relating to the 9-mm. sheet metal for the three forms of punch.

Fig. 5 relating to the different thicknesses for the principal, semi-cylindrical form.

It can be noted that, to obtain the greatest possible ϕc, there is an optimum die radius which, within the limits of our investigation, appeared to be larger for the thinnest sheet.

The value $r = 6$ appeared to be quite suitable for the selection of sheets proposed for the test (thickness 0.7 to 0.9 mm.).

IV—METHOD OF UTILIZING THE RESULTS

The results are given in the tables included in the appendix :

Table I. Investigation 54. Series No. 1.
Table II. Investigation 54. Series No. 2.
Table III. Investigation 59.

Such a collection of figures can be utilized in a number of ways, ranging from the simplest up to a full operational investigation, including calculation of all the correlations linking the ϕc with all the criteria, considered severally or grouped in all the possible combinations.

Clearly it was out of the question to undertake a work of this order and, furthermore, the nature of the variable factors would already have persuaded us to eliminate a great number of combinations of no physical significance.

During the progress of the investigation, moreover, different ways of interpreting the results became apparent and methods the usefulness of which was discovered during Investigation 59 have been applied retrospectively to Investigation 54, to supplement or replace less effective methods.

Therefore only the results of those different methods of utilization which have been retained will be given.

Comparison of Two Variable Factors

The first work undertaken in Investigation 54 was to compare the ϕc with the acceptance standards. Two methods were used :

(*a*) graphically, with orthogonal coordinates, which produces clusters of points, some of which have an orientation indicating a law :

(*b*) by calculating the coefficient of correlation R.

The Spearman method was used, this being a calculation of correlation of position which has the advantage of being relatively simple. The essentials are as follows :

Assume n objects A, B, C . . . classified by a preliminary test in a certain order (classification *x*) and classified by a second test in a certain order (classification *y*) generally different from the first.

Fig. 5.—Critical diameter as a function of the radius of entry of the die for sheets of various thicknesses

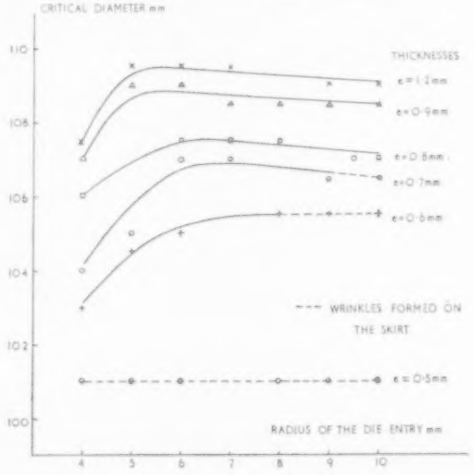


TABLE I—*Investigation 54—Series No. 1*

Sheet Ref. No.	Criteria							Critical diameters φc mm.
	A per cent	Am per cent	E/R	HR_B	IE	KWI		
						d per cent	$\mu'' \times 10^4$	
U	48.3	24	0.74	45	10.7	133	—	98.7
H	42.3	22.8	0.675	40	10.5	90	—	95.8
B	43.8	24.2	0.715	41	10.7	136	—	96.5
21	42.3	21.8	0.865	37	10.4	91	—	97.5
22	44.3	23.3	0.74	49	11.4	114	—	97.5
23	45.1	23.6	0.71	37.5	11.6	103	467	96.2
25	49.3	22.7	0.73	40	11.8	124	550	98
26	54.1	29.3	0.61	39	12.3	140	670	99.5
27	54	27.3	0.635	38	12.2	163	770	99
28	40	18.7	0.80	54	10.7	121	465	97
29	42	17.3	0.67	50.5	10.7	121	465	95
30	46.8	24.2	0.68	53	11.8	160	570	97.5
31	46.1	23	0.865	52.5	10.4	121	526	97
32	42.2	19	0.83	59.5	10.6	134	496	97
33	43.4	24	0.72	39	11.2	102.5	445	96
34	41.8	18.75	0.85	55	10.4	132	509	97
35	51.6	23.5	0.625	49.5	11.4	160	640	98.5
36	47	23.1	0.825	52.5	10.5	136	544	98
37	41.2	18.7	0.82	53	10.7	139	550	97.5
38	45.3	19.5	0.81	53.5	10.7	132	555	97.5
39	43.3	21.6	0.695	47	10.9	112	465	96
40	53.5	24.9	0.585	44	12.4	216	864	101
41	52.2	25.7	0.57	42.5	12.1	191	765	99.5

For greater simplicity, n objects A, B, C . . . will be considered, arranged in classification "x" according to the natural order of increasing integers, and below, the corresponding "y" classification.

	(K)	(A)	(P)	(D)	(Q)	. . .	(U)
Classification "x"	1	2	3	4	5	. . .	n
Classification "y"	5	8	3	1	9	. . .	p

Let:

n = the number of objects

x_i = the whole number in position i in the "x" classification (for instance, 2)

y_i = the whole number in position i in the "y" classification (for instance, 8)

TABLE II—*Investigation 54—Series No. 2*

Sheet Ref. No.	Criteria							Critical diameters φc mm.
	A per cent	Am per cent	E/R	HR_B	IE	KWI		
						d per cent	$\mu'' \times 10^4$	
A	44.25	21.75	0.825	53	10.2	117	515	107
B1	44.75	23	0.745	45	10.5	105	489	104
F	49.25	22.5	0.67	51	11.6	172	617	108
G	54.75	23.9	0.60	41.5	11.65	170	570	107
H1	49	21.75	0.715	46	10.75	127	645	106
I	52.5	22.6	0.775	42	11	144	655	107
J	44	21.9	0.82	52	10.35	160	666	108
K	49	23.3	0.765	46	11.35	153	640	107
L	53.75	23.7	0.67	38.5	11.75	180	840	107
M	45.25	20.8	0.77	52	10.5	148	567	106
N	52.2	27.4	0.61	52	12	195	820	110
O	51	24.8	0.71	56	11.6	184	740	109
P	47.1	18	0.81	61	10.5	159	725	110.5
Q	48	26	0.79	57	11.2	162	695	108.5
R	36.5	19.3	0.835	72	10	141	480	111
S	41.1	19.5	0.85	65	10.6	127	515	106.5
T	45.2	23.3	0.69	64	11	169	640	107
U1	54.9	27.7	0.62	40	11.9	169	770	104.5
V	38	16.3	0.90	64	9.4	124	510	106.5
W	41.7	19.5	0.90	64	9.9	110	450	107
X	47.6	23.9	0.88	57	10.6	152	660	106
Y	37.6	23.2	0.77	63	10.1	116	470	104
Z	50.3	23.9	0.775	50	11.4	160	700	107.5

TABLE III—*Investigation 59*

Sheet Ref. No.	Criteria											Critical diameters		
	A per cent	Am per cent	R	E	$\frac{E}{R}$	HR_B	IE	KWI		n ASTM	Length of flow area (mm)	P.P*	P.HS*	P.HC*
								d per cent	$\mu'' \times 10^4$					
1	42	29	32	18	0.56	39	11.90	170	890	7	0	102	100	102
2	39	29	33	20	0.60	40	11.30	180	1000	7	1	105	103	106
3	40	27	31	18	0.58	39	11.00	188	950	7	0	104	103	108
4	34	24	34	26	0.76	48	10.50	165	800	5/6	6	106	105	106
5	34	20	36	31	0.86	50	10.40	168	810	8	11	107	106	109
6	41	27	34	19	0.56	49	10.60	195	950	7.5	1	109	107	110
7	39	24	33	27	0.82	44	11.30	190	930	—	6	106	104	109
8	42	26	32	18	0.56	43	11.50	195	950	7	0	110	113	112
9	35	20	33	24	0.73	49	9.80	171	760	7	4	106	108	109
10	33	24	35	28	0.80	50	10.00	188	890	8	6	106	105	108
11	34	26	36	27	0.75	49	10.60	155	775	8	8	105	106	103
12	35	20	35	29	0.83	52	10.90	135	670	7/8	8	104	100	102
13	34	20	35	27	0.77	53	10.90	180	850	8	8	107	106	108
14	36	20	36	27	0.75	58	11.00	165	800	8	8	105	102	106
15	32	17	38	29	0.76	55	10.50	125	625	8	9	103	101	103
16	39	24	34	23	0.68	51	11.20	165	830	9	2	106	104	105
17	31	21	39	33	0.85	61	11.30	135	610	9	10	104	103	105
18	33	20	34	19	0.56	52	9.30	90	455	6	1	98	98	99
19	36	20	30	21	0.70	28	9.50	119	790	5.5	4	—	—	101
20	35	20	30	21	0.70	30	9.50	113	750	6	4	—	—	101

* P.P = Flat-headed punch.
P.HS = Hemispherically-headed punch.
P.HC = Semicylindrically-headed punch.

$d_i = x_i - y_i$ (for instance, 2—8 = —6).

The coefficient of correlation R between the classifications "x" and "y" is given by the formula :

$$R = 1 - \frac{6 \Sigma d_i^2}{n(n^2-1)}$$

R varies from —1 to +1, the positive values indicate that there is a correlation between the two classifications considered, the negative values indicate the reverse and a zero value indicates that there is an independence.

Comparison of More than Two Variables

To compare the φc values with several criteria, the latter have been combined in formulae giving a single value representative of a group and thus the preceding case is recreated.

In the particular case of two criteria, a geometrical method has facilitated the search for a possible relationship between these parameters.

A graph was prepared giving the two inspection standards on the abscissae and ordinates, each point carrying in addition the value of φc.

By joining points having the same φc value, fair curves were plotted which made it possible to imagine the surface representing the function linking the three parameters.

In certain cases, this surface can be assimilated to a plane, the equation of which is then easily determined.

Thus there is a formula determining a φc value as a function of two criteria and it is then possible, as previously, to determine its correlation with the real φc.

This method has the advantage of allowing certain relationships to be presumed, but it must be admitted that a sufficient number of points is not yet available to turn it to advantage.

First established were the relationships between the φc and the acceptance standards considered individually.

As stated previously, the second series in Investigation 54 had shown a greater independence between φc and the acceptance standards, and this suggested that this would no longer be true if, to characterize the sheet metal, a formulae could be devised which would incorporate a certain number of criteria.

The selection of the latter was based on their physical significance in order to avoid duplication, and the coefficients were selected somewhat arbitrarily, to give equal importance to each criterion.

Table IV gives the Spearman coefficients R of these various comparisons for the whole of the two investigations.

Parallel graphical comparisons were made and these did not disclose or suggest the possibility of other relationships and it can be observed that to any R value below 0.40 there is no corresponding visible orientation of the cluster of points.

TABLE IV—*Correlation between φc and Different Criteria or Groups of Criteria—Value of R*

Criteria	Investigation 54		Investigation 59		
	Series No. 1	Series No. 2	Flat	Hemispherical	Semi-cylindrical
A per cent	0.76	0.15	—0.28	0.22	0.29
Am per cent	0.56	0	0.06	0.13	0.19
E/R	—0.21	0	—0.02	—0.1	0.05
IE	0.54	0.29	—0.01	—0.15	0.25
KWI (*d* per cent)	0.67	0.51	0.66	0.59	0.87
(μ)	0.59	0.33	0.51	0.35	0.66
HR_B	0.16	—0.06	—0.16	—0.20	—0.01
(1) 5 criteria A, IE, *d* per cent KWI E/R, HR_B	0.43	0.19	0.37	0.37	0.35
(2) 3 criteria A, IE, *d* per cent KWI	0.78	0.34	0.41	0.32	0.62
(3) 2 criteria IE, *d* per cent KWI	0.69	0.37	0.46	0.39	0.74
(4) 2 criteria A per cent, *d* per cent KWI	0.77	0.31	0.46	0.41	0.57

Formulae used for the groups of criteria.

(1) A per cent + 5 IE + 0.3 *d* per cent KWI—70 E/R—HR_B

(2) A per cent + 5 IE + 0.3 *d* per cent KWI.

(3) 5 IE + 0.3 *d* per cent KWI.

(4) A per cent + 0.3 *d* per cent KWI.

SECTION V—RELATIONSHIPS DISCLOSED

1. *Relationships Obtained from the Overall Picture of Table IV*

A first advantage is to be gained by reading this Table, disregarding values below 0.40.

From this, the following laws were deduced :

(*a*) The results of Investigation 59 (flat punch) confirm those of Investigation 54 on the following point :

If a " tool and work piece " combination produces a correspondingly improved metal flow, it is less sensitive to the properties of the sheet metal.

This law, which it is rarely required to apply in practice, enables us, however, to explain the sometimes paradoxical success of sheet metal adjudged of poor quality on acceptance.

(*b*) The KWI test (characterized by the value *d* per cent) continues to give the best coefficients of correlation, as was already apparent in Investigation 54.

2. *Relationships Derived from the Results Obtained with the Semi-Cylindrical Punch*

The semi-cylindrical punch (Investigation 59) proves to be more selective than the others and gives a more evenly spread distribution, as is shown by the calculation of the typical differences in the φc distribution.

Type of punch	δ
flat	2.6
hemispherical	2.9
semi-cylindrical	3.5

The desired result is therefore attained and we shall utilize the results obtained for a closer analysis of the phenomenon.

(*a*) *Preponderating influence of the KWI test*

The most closely approximate formula giving φc as a function of *d* per cent has been established. This is : φc = 0.105 *d* per cent + 89.

The coefficient of correlation between φc calculated and φc real is then 0.87.

(*b*) *Influence of* HR_B

φc is maximum for $HR_B = 43$.

In an attempt to link this important observation with that of the good selectivity of *d* per cent KWI, the most closely approximate formula giving φc as a function of *d* per cent and HR_B has been determined.

By the method of fair curves described above, two formulae have been obtained (for there are two distinct planes, φc being equal to the smaller of the values thus calculated) :

φc = 0.073 *d* per cent + 0.17HR_B.

φc = 0.095 *d* per cent — 0.125 HR_B.

The coefficient of correlation between φc calculated and φc real is 0.98 in the first case and 0.87 in the second.

(*Continued in page* 918)

Investigation on Predetermining the Deep-drawing Capacity of Light Sheet Metal

(*Continued from page* 917)

This is a curious illustration of the influence of HR_B.

(*c*) *Influence of n*

The optimum grain-size is 7.

Notes

During this investigation, it was possible to note the following :

(1) The elastic limit E depends directly on the length λ of the area read on the diagram.

In the experimental conditions :

$$E = \frac{10}{8}\lambda + 18.1$$

The correlation with the real value reaches the surprising value of R = 0.96.

(2) Certain tests on brass and AG3 have disclosed laws somewhat different from those revealed for mild steel.

In particular, for AG3, the form of the punch is a preponderant factor : a ϕc of 101 with a flat punch becomes 86 with a hemispherical punch.

VI—GENERAL CONCLUSIONS

Finally, two principal groups of results can be considered in this work.

(1) Series No. 1 in Investigation 54 which approximates to the usual deep-drawing conditions, in which the shapes of the part and of the tool impose stresses on the metal which it is not possible to rationalize.

A good correlation is to be found between the ϕc and certain criteria, such as : A per cent, IE, *d* per cent KWI and naturally with the formula combining them.

On the other hand, no discrimination in the E/R value was disclosed.

As regards HR_B, no direct correlation is found, but an optimum value. This has been confirmed in the later stages of the investigation.

It should be noted that R closely follows the HR_B value.

(2) The results obtained with the hemispherical punch in Investigation 59.

This form was particularly well suited to the requirements of the problem involved, *i.e.* obtaining from the actual shape of the drawn part the maximum tangential stresses.

From this, we deduce a very close relationship between ϕc and *d* per cent KWI and the existence of optimum values for HR_B and *n* (grain-size).

These results may appear meagre but we are continuing our investigation with the lighter weight sheets currently used. We shall also test, in collaboration with our associates, other criteria and hope to be able to make, with their help, some advantageous progress in this direction.

NEW WELDING TECHNOLOGY DEPARTMENT WILL PROVIDE A COMPREHENSIVE SERVICE FOR INDUSTRY

THE British Welding Research Association announces a number of important changes in its internal administration. They will have the effect, on the one hand, of extending the scope of the services provided for industry and, on the other, of enabling fundamental work, particularly in arc physics, to develop unfettered.

Under the new arrangement, which came into effect on November 1, the former Welding Process and Resistance Welding sections have been integrated into one Welding Technology Department with wide terms of reference. These include carrying out such research as is necessary to extend the range of usefulness of existing welding processes, to promote the effective use of welding methods, to assist in the selection of processes for particular applications and to provide basic data for the design of welding plant. The department will be given extended facilities for investigating all new methods of welding and welding technology and will make available assessments of the usefulness of these for general and specific purposes.

Administration of the new department is the responsibility of Mr. P. T. Houldcroft, formerly the Association's Chief Metallurgist, who now becomes Head of the Welding Technology Department, with Mr. A. A. Smith, formerly in charge of the Welding Process Section, as Deputy Head. Complete administrative responsibility for, and control of, the metallurgical laboratory is assumed by Mr. H. F. Tremlett, the Deputy Director of Research, with Dr. R. G. Baker and Mr. J. G. Young as Chief Metallurgists in charge, respectively, of ferrous and non-ferrous researches.

Interest in the physics of the electric arc, including the development of techniques for controlling and utilising ultra-high temperature arc plasma, and in the development of electronic control and monitoring systems, has now reached the stage where it is necessary to allow these investigations complete freedom to continue and expand if their potential is to be exploited. This work will now be fully under the control of Dr. A. A. Wells, the Assistant Director of Research, who also controls the Association's engineering researches.

The integration of the resistance and arc-welding processes, will bring into line such "fringe" processes as friction and electron beam welding, up to now regarded as self-contained projects, and will enable their use to be considered along with that of the more conventional processes in connexion with, for example, the D.S.I.R.-aided Prototype Welding Service recently provided for the benefit of member firms.

High-speed Refrigerator Cabinet Production

(*Continued from page* 910)

tangent bent and tack welded to the bottom unit. A transfer device moves the cabinet to the "down-ender" machine. Here it is positioned for the final welding operation.

The corner seam and two spot-welding station, which follows performs 20 welds of four different types. The exit side offers ample room for any maintenance operations required. The next machine in the line is a backwelder. It places 88 spot welds around the back cabinet panel; 140 resistance welds hold the cabinet together before it moves on for further operations.

High-speed Multiple Bender

Another refrigerator company which has manufactured home units for 68 years for the trade uses a notable Taylor-Winfield three-slide door-forming machine. The latter produces 60 refrigeration cabinets doors per hour with a single machine operator. Fig. 2 shows the sequence of bending operations. In order to increase output two operators are employed in this instance. One handles the sides of the door and the other operator forms the ends (Fig. 3).

The user chose this machine because it is no longer necessary to use an expensive sheet drawing operation or a slow bending sequence in a press brake. This high-speed bending machine forms one side and one end of the refrigerator door at the same time.

The 20-gauge door has a total of 12 in. "wipe bends", three on each of the four sides. The first bend has a 0.25 in. radius ; the 1-in. return flange is made with 1.125 in. radius. The 0.37-in. inner flange is bent 30 deg. The sequence of "wipe bends" as they are made at high speed in this machine is illustrated in Fig. 3.

Acknowledgement is due for data and illustrations to the manufacturers of the equipment described The Taylor-Winfield Corp., Warren, Ohio, U.S.A.

The International Research Association for Mechanical Production Engineering

(*Continued from page* 908)

or telephony, without the help of the machining experts, the technique of interchangeable parts and the art of metrology, scientifically developed ?

In addition to that part of humanity which requires consumer goods, it is necessary to consider also the men who make those goods; the labour force in the production field. While goods are to be produced ever quicker and ever in greater quantity, the producer must be aided to produce these goods in less and less time and with less and less effort, free from nervous haste and tension.

Hence the need: for better machines, better tools, higher speeds, more convenient handling and operation, more automation; and, on the human side, better working conditions and more protection from any injury to health and well-being.

It is for these targets that the C.I.R.P. wishes to harness the combined research activities of the production engineers and scientists of all countries.

INTERNATIONAL METAL SPRAYING CONFERENCE

AFTER the success attained in the two former International Metal Spraying Conferences held at Halle (Germany) and Birmingham (Great Britain), the Spanish Institute of Welding has been charged to prepare the III Conference on Metal Spraying and allied subjects, to be held at Madrid from May 21 to 25, 1962.

The Executive Committee has established the following index of subjects to be dealt; other matters may be added:

1. The fundamental science of metal spraying.
2. The design of metal spraying tools, electric and gas.
3. The choice of metal deposits.
4. Commercial uses of the process.
5. New developments.
6. Economic aspects.
7. Health hazards.
8. Flame spraying for hard facing.
9. Flame spraying of ceramics.
10. Flame spraying of plastics.

Official languages will be French, English and Spanish and the enrolment fees will be 1,700 Ptas. per delegate and 340 Ptas. per person accompanying delegates. Detailed information can be obtained from the Institute de la Soldadura (Secretariat of the III International Metal Spraying Conference), Serrano, 144-A, Madrid 6, Spain.

ALUMINIUM LECTURE AT THE SCIENCE MUSEUM

THE Science Museum educational lectures for VIth form students and others included, on November 14 and 15, a lecture by Dr. E. G. West, Technical Director of the Aluminium Development Association. His talk, which was enlivened by demonstrations, experiments, film excerpts and slides, covered the chemical background of aluminium, its production, physical and mechanical properties, principal metallurgical properties, and an indication of its widespread uses in engineering.

FOR OUR OVERSEAS READERS

(Continued from page 861)

Résumés des Principaux Articles

Prédétermination des propriétés d'emboutissage profond de tôles minces selon les essais en laboratoire et la mise au point d'un prototype embouti de panneau de carrosserie de voiture

page 911

Par M. Jentet.

Une étude antérieure (1954) *a établi la corrélation entre divers essais classiques et les résultats obtenus lors de l'emboutissage profond d'une coupelle en prenant comme caractéristique le diamètre maximal de la galette susceptible d'être emboutie sans déchirage (diamètre critique).*

Ces essais ont démontré qu'après amélioration de l'outillage en vue de faciliter l'écoulement du métal, la propriété d'emboutissage profond d'une galette de diamètre donné est moins subordonnée aux caractéristiques classiques de la tôle utilisée.

Cette loi n'a été démontrée que pour le cas à l'étude, c'est à dire pour une pièce emboutie très simple, dans lequel cas les conditions technologiques de l'essai seraient peut-être plus importantes que la forme même de la pièce; ces conditions ne se reproduisent pas lors des emboutissages pour carrosserie de voiture.

C'est pourquoi l'auteur a utilisé une pièce emboutie plus compliquée qui retient toutefois une forme se prêtant à une évaluation rigoureuse des résultats obtenus.

Tout comme dans cette expérience, on a comparé les caractéristiques classiques aux diamètres critiques présentés par ce nouveau type de pièce emboutie, et l'on a établi les lois de corrélation.

On a aussi fait la comparaison des résultats obtenus avec ceux des emboutissages cylindriques, à fonds plats ou hémisphériques, afin d'établir un rapport entre ces nouveaux résultats et l'étude antérieure; enfin les lois résultantes ont été exposées.

Zusammenfassungen der Hauptartikel

Vorausbestimmung der Tiefziehbarkeit von Leichtmetallblechen in Laboratoriumsversuchen und die Entwicklung eines gezogenen Urmusters für Kraftwagenkarosseriebleche .. Seite 911

Von M. Jentet.

Eine frühere Untersuchung (1954) *ergab den Zusammenhang zwischen verschiedenen üblichen Prüfverfahren und den beim Tiefziehen eines Bechers erzielten Ergebnissen, wobei der maximale Durchmesser des Rohlings, der noch ein Ziehen ohne Reissen zuläßt (kritischer Durchmesser), als Kennwert benutzt wurde.*

Diese Untersuchungen ziegten, daß durch verbesserte Werkzeuge und entsprechend verbesserten Metallfluß die Tiefziehbarkeit eines Rohlings von vorgegebenem Durchmesser nicht mehr so stark von den üblichen Kennwerten des Bleches abhängt.

Dieser Sachverhalt wurde nur für den untersuchten Fall nachgewiesen, d.h. für einen sehr einfachen Ziehteil, für den die technologischen Bedingungen der Prüfung möglicherweise von größerer Bedeutung sind als die Form des Teils, was im Falle von Pressteilen für Kraftwagenkarosserien nicht zutrifft.

Aus diesem Grunde benutzte der Verfasser einen komplizierteren Ziehteil unter Beibehaltung einer Form, die eine strenge Auswertung der Versuchsergebnisse gestattet.

Wie bei den obengenannten Arbeiten wurden die üblichen Kennwerte mit den für die neuen Ziehteile geltenden kritischen Durchmessern verglichen und die Korrelationsgesetze bestätigt.

Die Versuchsergebnisse wurden auch mit denen von zylindrischen Hohlkörpern mit flachen bezw. halbkugeligen Böden verglichen, um die neuen Ergebnisse mit der früheren Untersuchung in Beziehung zu bringen; die sich dabei ergebenden Gesetze wurden aufgestellt.

Résumenes de los Artículos Principales

La predeterminación de la capacidad para el estampado profundo de chapa metálica de pequeño calibre a base de ensayos de laboratorio y la creación de un prototipo estampado representando paneles de carrocerías de coches

página 911

Por M. Jentet.

Una investigación anterior (1954) *ya estableció la relación existente entre los diversos ensayos convencionales y los resultados obtenidos en el estampado profundo de una copa, empleando como característica el diámetro máximo en blanco que puede estamparse sin rotura (diámetro crítico).*

Estos ensayos demostraron que mejorando las herramientas para facilitar el flujo del metal, la capacidad para el estampado profundo de un disco blanco de un diámetro determinado se hace más independiente de las características convencionales de la chapa metálica empleada.

Esta ley solamente quedó demostrada en el caso estudiado o sea con una pieza estampado de modelo muy sencillo, para el cual las condiciones tecnológicas de la prueba eran más importantes que la forma en si de la pieza y estas condiciones no rigen en el caso de estampados para carrocerías de automóvil.

Por este motivo el autor ha empleado una pieza estampado mi complicada de forma pero una forma que aun se presta a una rigurosa evaluación de los resultados obtenidos.

Como en el trabajo más arriba citado, se han comparado las características convencionales con los diámetros críticos de este nuevo tipo de pieza estampada y se han establecido las leyes de correlación.

Los resultados se han comparado también con los obtenidos con cascos cilíndricos dotados de fondos planos o hemisféricos para relacionar estos nuevos resultados con investigaciones anteriores, habiéndose establecido las leyes consiguientes.

SHEET METAL NEWS

FEATURING EVENTS AND PERSONALITIES IN THE INDUSTRY

PRODUCTION ENGINEERS' PRESIDENT SUGGESTS MORE SCIENTIFIC APPROACH TO PRODUCTIVITY

AT the annual dinner of the Institution of Production Engineers held recently at the Dorchester Hotel, London, the president Mr. Harold Burke, took a strong line in his address. With a delivery befitting an engineer of his standing Mr. Burke tilted at present-day top management organization and the country's general level of productivity, and made several suggestions aimed at bringing about a more scientific approach to the problem.

He insisted that stimulation should come initially from the Government and that a start could be made by appointing a leading industrialist as Minister of Production, quoting as an example the recent appointments in British Railways. One could have read into his remarks that there were advantages to be gained from a "nationalized industry" but one also felt that his point would have carried more weight if the analogy had been more carefully chosen, and the idea had a mixed reception.

Mr. Burke also suggested that British universities should run degree courses in Production Engineering to offset the sometimes shattering experiences encountered every year by young engineers reaching managerial positions.

The principal guest at the dinner, Lord Chandos, in an amusing non-commital reply, designed no doubt as is generally the case to avoid misquotes rather than quotes, wisely suggested that industry helping itself to a better performance would be a more satisfactory solution and would most probably show better returns. He did, however, endorse Mr. Burke's feelings for closer ties between scientific and engineering education and business management studies.

Lord Chandos then presented the following awards:

The Institution Medal, 1960, for the best Paper presented to a Region or Section by a non-member, Mr. E. P. Ward, for his paper "National Character Dictates Production Methods".

The Institution Medal, 1960, for the best Paper presented to a Region or Section by a member, Mr. K. J. Hume, for his paper "Developments in Dimensional Accuracy".

The J. D. Scaife Medal, 1960, for the best Paper published in the Journal of the Institution (other than those presented to Regions or Sections), Mr. H. Grisbrook, for his paper "Precision Grinding Research".

The Lord Austin Prize, 1960, for the best essay submitted by a graduate to Mr. P. J. Varley, for his essay on "The Maintaining of Production Potential with Shorter Working Hours by means of Advanced Management and Production Techniques".

Schofield Travel Scholarship, 1960, to Mr. J. S. Hawkins.

CANADIAN FIRM APPOINTS BRITISH AGENTS

THE Roller Die Co. Ltd., 104 Evans Avenue, Toronto 18, Canada, have appointed as sole European sales, service and installation engineers for their products, G. E. Simm Engineering Ltd., 27 Broomgrove Road, Sheffield 10. The Canadian company manufacture a complete range of high-productivity equipment for the sheet-metal industry including decoiling and shearing lines, roll-forming machines, high-speed presses, uncoilers and recoilers, single- or multi-strand edge condition machines for strip, and high-speed slitting lines, etc. Further details of these machines will be given in the "New Plant and Equipment" section in subsequent issues of this Journal.

£1,500,000 EXTENSIONS FOR W. H. A. ROBERTSON AND CO.

New Scope for Heavy Rolling Mill Equipment

THE £1,500,000 extension to the works of W. H. A. Robertson and Co. Ltd., Bedford (a member of the Tube Investments Engineering Division) which was held up in June, is now being resumed, and should be completed by the end of 1962.

The hold-up was due to the shortage of skilled labour and difficulties foreseen in manning the extensions, matters which have been met by a housing agreement with the Bedford Town Council.

The project will include heavy machine and erection bays capable of handling weights up to 300 tons, this placing Robertsons in an advantageous position for heavy plant manufacture.

W. H. A. Robertson and Co. design and produce rolling mills, forging machines and other engineering plant and equipment.

BRIGHTON FIRM ACQUIRE NORTHERN IRELAND FACTORY

ALLEN WEST and CO. LTD., electric motor control gear manufacturers, of Brighton, have acquired a 56,000 sq. ft. Government built factory at Newtownards, Co. Down.

The factory has ample room for expansion and will immediately go over to the assembly and wiring of standard Allen West contactor panels, giving continuity of employment to the skilled labour force.

As the volume of work increases, it is anticipated that the factory strength will be considerably augmented and in three to four years will be brought up to about 400.

It is hoped that the works manager will be a local appointment and other personnel, as required, will be recruited locally. It is not intended to transfer permanently any of the Brighton staff to Northern Ireland.

PLANS TO PROMOTE LEAD

THE formation of the European Lead Development Committee to co-ordinate and expand promotional work throughout Europe is announced following meetings in Rome between representatives of the French, German, Italian, Spanish and United Kingdom lead development associations and the Belgian and Swedish lead producers. The LDA, London, will be responsible for the secretarial work of the new committee under the guidance of a steering group comprising France, Germany, Italy and the United Kingdom.

The consumption of lead in all forms in Europe has risen in the last four years by about 120,000 tons (11 per cent) to 1,200,000 metric tons in 1960. Preliminary figures for the first half of 1961 show that the growth is continuing for Europe as a whole despite some levelling off in the United Kingdom, where consumption per capita is the highest in the world.

This expansion in consumption is the result of the steady growth of most uses. Batteries now consume 30 per cent more lead than four years ago, the rise, which is expected to continue, reflecting the more widespread use of motor cars. The use of lead for radiation shielding is expanding but precise figures are not available in all countries.

The meeting completed preliminary arrangements for the first International Conference on Lead to be held in London from May 22 to 25, 1962. The emphasis will be in the use of lead for batteries, cables and nuclear shielding, and other sessions will cover economic trends and research. The full programme will be announced later.

Technical aspects of many lead uses were examined by the Committee. There are differences in the techniques used in various countries for lead cable sheathing and these will be described in special reports shortly to be issued. In sheet and pipe, too, there are striking contrasts in applications which will be illustrated in forthcoming international publications, showing lead in modern building. The need for better sound insulation is creating new demands for lead which, because of its weight and limpness, is specially suitable as a sound barrier.

The future activities of the Committee include the publication of technical and promotional booklets and a European lead bulletin.

GERMAN ROLLING MILLS IN THE U.K.

AT present, a continuous billet mill and a continuous rod mill including all ancillary equipment are being built by Schloemann Aktiengesellschaft, Dusseldorf, for Appleby-Frodingham Steel Co. Ltd., Scunthorpe. Both plants are scheduled to commence production in 1962.

The four-stand billet mill with advance two-high reversing stand will be chiefly used for preparation of the starting material required for the rod mill; it will also manufacture semi-products for direct resale.

The rod mill is designed to handle a diameter range from $\frac{3}{8}$ in. to $1\frac{1}{4}$ in. at a monthly output of up to 30,000 tons. The unit provides for four-strand rolling in the roughing train, and two-strand operation in both intermediate trains, as well as the finishing trains.

NEW DEVELOPMENT COMPANY FOR MANUFACTURERS OF MARKING MACHINES

EDWARD PRYOR AND SON LTD. of Broom Street, Sheffield, 10, manufacturers of marking devices, announce the registration of a new company known as "Edward Pryor Developments Ltd." The Development Company will devote its activities to the design of automatic marking machines and ancillary equipment. The Board of the new company is Mr. G. R. Pryor, Hon.M.I.Prod.E. (Chairman), Mr. A. Throp, M.I.Mech.E., F.B.I.M. (Managing) and Mr. A. E. Godbehere, A.Met., A.I.M. Mr. Throp remains on the board of Edward Pryor and Son Ltd., but relinquishes his executive position and is succeeded as deputy managing director by Mr. C. Ellis, A.M.I.Mech.E., M.I. Prod.E.

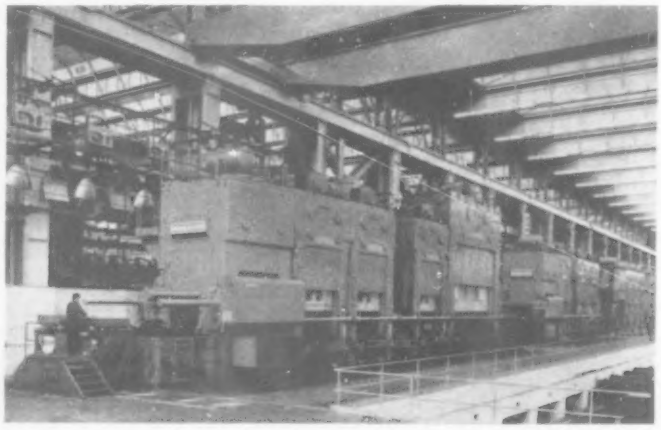
TRANSFER LINES AT THE VOLKSWAGEN FACTORY

THE illustration shows two Weingarten fully automatic press transfer lines. Two of the finished work-pieces produced on these lines can be seen on the conveyors which run along the back of the press lines at two different levels, one being an inner door panel and the other an outer door panel. For these components, the operator places the blank into the infeed device at the head of the line and the whole set-up is entirely automatic from then on. The Weingarten press at the head drives the automatic feed which grips the work-piece at each tool station, raises it and feeds it forward to the next tool station. The first press also engages the subsequent single-acting crank presses which operate on separate strokes.

In the first line shown, an annealing station is provided after the third press. If required, it is possible to provide a welding station in a similar way.

If the machines are required for small batches it is simple to remove the feed mechanism and feed each press by hand. In this case feeding takes place at right angles to the transfer feeding. Instead of blanks it is also possible to feed coil material, the line then becomes fully automatic.

British agents for Weingarten presses are Pearson Panke Ltd., 1-3 Hale Grove Gardens, London, N.W.7.



BRITISH MANUFACTURERS EQUIP ELECTRICAL LABORATORY IN HONG KONG

WHILE the British Electrical and Allied Manufacturers' Association were holding their Golden Jubilee Export Conference in London in October, Mr. Frederick Erroll, Minister of State, Board of Trade, was officially opening a new electrical laboratory equipped by leading BEAMA manufacturers at the University of Hong Kong.

Mr. L. H. Short, chairman of the Export Panel of BEAMA, said that the University's electrical power station and engineering laboratories had been originally equipped with the help of member firms in 1913. During the Japanese occupation the laboratory had been completely stripped, and lack of finance had prevented the re-establishment of the University's technical courses in electrical engineering. This was most serious, particularly as from 1912 the widest recognition of the University's Bachelor of Science (Engineering) degree had been given by institutions all over the world, including the British Institutions of Electrical Engineers and of Mechanical Engineers. An appeal for help once again was made to the BEAMA in 1959, as a result of which a number of leading British electrical manufacturers, supported by associates in Hong Kong, donated the machinery and equipment required.

AID FOR INDIAN COLLEGE

THE F.B.I. recently invited Mr. R. N. Dogra, principal of the Delhi College of Engineering and Technology, to meet Mr. P .F. D. Tennant, C.M.G., O.B.E., Overseas Director of the F.B.I., and other representatives of British industry at F.B.I. headquarters.

British industry has provided over £250,000 towards the equipment of the College, while the British Government is providing some fifteen professors over periods of five years and a number of additional services. The Government of India is providing the buildings and all other staff, services, and locally available equipment.

The first group of 150 students studying at the College are equally divided between the departments of civil, mechanical, electrical, chemical engineering, and textile technology.

The Duke of Edinburgh laid the foundation stone of the College in January, 1959.

NEW AGENTS FOR INCREASED EUROPEAN TRAFFIC

THE Transport Ferry Service have appointed three new agents in Western Germany to assist in handling the increasing freight trade between Great Britain and Northern Europe. Announcing this news, Mr. Michael K. Bustard, newly-appointed general manager of the Service, said: "Lorries and trailers using our roll-on roll-off service between Tilbury and Antwerp/Rotterdam have greatly increased over the last 12 months. The most striking increase in trade between the United Kingdom and West Germany has been in the field of machinery and machine tools. The special equipment presently operated by international road hauliers using the Transport Ferry Service is specially designed to carry this traffic.

"These new agents in West Germany, who will be reinforcing Reedereikontor Eberhard Biedermann of Dusseldorf, will help this increased volume of traffic from Common Market countries to the United Kingdom".

The agents appointed are: Fisser and v. Doornum of Hamburg, Hans-Joachim Leue of Frankfurt am Main, and Hugo Stinnes of Munich.

FERRANTI ACQUIRE INTEREST IN ITALIAN TRANSFORMER COMPANY

FERRANTI LTD. have acquired a large interest in the Italian company, Industrie Elettriche di Legnano of Milan, one of the leading transformer manufacturers in Italy.

This acquisition by Ferranti marks the culmination of a period of technical co-operation with Industrie Elettriche di Legnano which commenced two years ago. The agreement entered into at that time provided for the exchange of research and development information relating to transformers.

Industrie Elettriche di Legnano of Milan are recognized throughout the Continent for their high standards in transformer design, and have facilities for the manufacture of the largest transformers.

Ferranti Ltd. are one of the largest manufacturers of transformers in Europe, and recently announced an order of over £1 million from the Central Electricity Generating Board for four of the largest generator transformers in the world.

PRIMARY MILL FOR PARK GATE'S NEW STEELWORKS

DAVY and UNITED ENGINEERING CO. LTD. (a member of the Davy-Ashmore Group) has secured a contract from The Park Gate Iron and Steel Co. Ltd. for a 42 in. × 104 in. reversing blooming mill, complete with a full range of auxiliary equipment, for the new integrated steelworks which Park Gate are now establishing on a new site on the outskirts of Rotherham. The value of the contract is approximately £1 million.

Park Gate's development project has as its initial aim the increasing of annual ingot capacity from 425,000 tons to 800,000 tons a year. The increased output of steel is intended to help meet both the internal needs of the T.I. Group, of which Park Gate is a member, in the production of steel tubes and other engineering products, as well as those of Park Gate's own customers.

The new Davy-United mill will be the primary rolling unit of the works and is being designed to roll ingots up to 5 tons in weight in carbon and rimming steels and certain low alloy steels. Driven by twin 3,000 h.p. motors, the mill will eventually supply blooms ranging from 5 in. × 5 in. to 14 in. × 14 in. square, to feed continuous billet, and narrow strip mills which Park Gate also propose to install, as well as the existing finishing mills.

OPEN GENERAL EXPORT LICENCE FOR IRON AND STEEL SCRAP

AT the request of the Ministry of Power the Board of Trade announce arrangements permitting the export of compressed baled iron and steel scrap not exceeding an f.o.b. value of £25 per ton, and of iron and steel scrap turnings and bearings not exceeding an f.o.b. value of £25 per ton from October 31, 1961, until February 28, 1962. An Open General Licence has been issued permitting the export of this material to any destination during the period October 31 to February 28, 1962 (inclusive).

Enquiries should be made to the Board of Trade, Export Licensing Branch, Gavrelle House, Bunhill Row, London, E.C.1 (telephone: Monarch 4071). Copies of the Open General Licence (price 3d. each, by post 5½d.) are obtainable from H.M. Stationery Office, Kingsway, London, W.C.2, and branches.

FORMING CORRUGATED CULVERT

NEW forming equipment, designed and built by Pacific Roller Die Co., Inc. of Hayward, California, for U.S. Corrugated Culvert, is capable of producing locked-seam spiral corrugated culvert faster, more economically, and in a larger range of sizes than ever before.

Using the new equipment, the company can fill orders in far less time than others using conventional machinery. Six to 8-in. dia. culvert can be produced at a rate of 15,000 lineal ft. per day, as compared with an estimated output of 800 lineal ft. per day by manufacturers of riveted-seam spiral corrugated culvert of the same size.

In addition to its greater speed, the U.S. Corrugated Culvert production line can be operated by only three men—a mill operator and two men on the runout table—compared with as many as 15 required to operate other types of machinery used to produce the same material.

The new equipment is easily adjustable to the production of any diameter culvert, from 6 to 48-in. At present, U.S. Corrugated Culvert is the only manufacturer capable of mass-producing locked-seam spiral corrugated culvert in this range of sizes. The only adjustment necessary to change the diameter is to change the angle at which coils of galvanized or hot-rolled steel sheet are fed into the forming equipment.

Finished culvert is automatically cut into any desired length to fit customer specifications or shipping requirements by a flying saw adjacent to the runout table. Lengths are precisely controlled by adjusting a gauge on the runout table.

The equipment is compact, simple and efficient, giving trouble-free operation and accurate forming, with no scratches or checks in the galvanizing. The spiral locked seam is formed on the sides of the corrugations, producing the strongest possible sections.

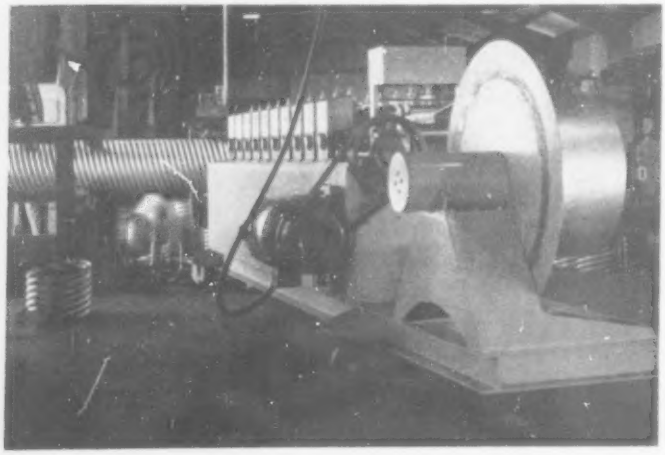
Coils are fed into the machine at either 45 or 90 ft. per minute, the slower speed being used for heavier gauge material.

U.S. Corrugated Culvert is produced in two corrugation designs: 1½-in. pitch by ¼-in. depth, and 2-in. pitch by ½-in. depth. The smaller corrugations are used on 6, 8, and 10-in. dia. culvert, the larger corrugations on 12 to 48-in. dia. sizes.

Locked-seam spiral corrugated culvert is made from 18- to 12-g. Beth-Cu-Loy galvanized sheets, manufactured by Bethlehem Steel Co. Sheets are supplied in 29-in. wide coils, slit to make two 14½-in. coils. Bethlehem sheet is specified exclusively for production of the culvert.

The company produces culvert used for conduit, heating and ventilation ductwork, drainage and transportation of fluids. Plans are being made to include a perforating operation which will produce perforated culvert with positive control in alignment of holes.

Equipment for the production of locked-seam corrugated culvert



WELDING IN SHIPBUILDING

THE autumn meeting of the Institute of Welding took the form of a Symposium on Welding in Shipbuilding, organized jointly with the four leading British Shipbuilding institutions (Royal Institution of Naval Architects, Institute of Marine Engineers, N.E. Coast Institution of Engineers and Shipbuilders, Institution of Engineers and Shipbuilders in Scotland). It is believed that this was the first full-scale symposium devoted to this subject anywhere in the world.

Thirty-four technical papers, 14 from the U.K. and 20 from seven other countries, were presented at seven technical sessions from Monday, October 30 to Friday, November 3. About 400 delegates registered for the Symposium, which was opened by Vice-Admiral Hughes Hallett, Parliamentary Secretary to the Ministry of Transport. During the week receptions were held by the chairman and committee of Lloyd's Register of Shipping, The Shipbuilding Conference and by the Institute itself following the address given by the president of the Institute, Mr. H. West. M.Sc., M.I.Mech.E., M.I.E.E., M.Inst.W.

The Institute's annual dinner was held at The Connaught Rooms, London, on Wednesday, November 1, at which the toast of the Institute was proposed by the principal guest, The Rt. Hon. Lord Carrington, K.C.M.G., M.C., First Lord of the Admiralty. Following a reply by the president of the Institute, the Vice-president of the Institute, Mr. L. Redshaw, M.Eng., M.R.I.N.A., proposed the toast of the Guests, the response being given by Mr. F. I. Geddes, M.B.E., C.I.Mar.E., chairman of the technical committee of the Chamber of Shipping.

NEW M.I. COMPANY IN CANADA

METAL INDUSTRIES LTD. is setting up a new company in Canada. It will be known as Dominion M.I. Ltd. and will have its head office and works in Montreal with a branch office and repair department in Toronto.

Dominion M.I. Ltd., will be concerned with the promotion of the M.I. Group's products in the Canadian market and with the manufacture of specialized electrical control systems and equipment.

President and general manager of the new company, will be Mr. E. A. Chandler; general sales manager will be Mr. D. J. Tamblyn.

PROTECTION OF STAINLESS STEEL SHEETS

A NEW method of giving polished stainless steel sheet a protective covering has been developed by Firth-Vickers Stainless Steels Ltd. of Sheffield.

The covering, made of PVC, or latex-backed paper, results from several years of experimental work carried out by Firth-Vickers, who have long realized the importance of avoiding unnecessary damage to polished sheet during transit and handling at fabricators' works.

As manufacturers, Firth-Vickers handle sheets with great care at all stages of production, any polished sheets showing signs of accidental damage being rejected. The finished sheets are carefully packed using a fine tissue paper or cellulose wadding as interleaving between adjacent polished surfaces so that when despatched they are in perfect condition.

When, however, polished sheets are unpacked at fabricators' works there are many opportunities for damage. Warehouse facilities may be inadequate or staff may be inexperienced and unaware of the cost of the material they are handling. Abrasion and scratching can occur while sheets are being cut into blanks or through the careless stacking of blanks at a press.

There was no widespread demand for protective coverings from users of stainless steel sheet until thin PVC film with a low tack adhesive back became available. Used initially for covering 4-in. wide polished strip, it was at first applied by hand, one man holding the roll and allowing the film to peel off while a second man applied it to the strip surface, attempting at the same time to eliminate air bubbles and creases. A small number of polished sheets were also covered experimentally with this narrow material, a number of parallel strips of PVC being put on edge to edge, but this was a laborious process and the labour cost was unreasonably high.

The next stage in development was to construct for the 4-in. wide strip a small pinch-roll laminating device with side guides for the strip. This successful small machine was the forerunner of further laminating machines which Firth-Vickers designed and built for sheet protection. The latest machine is motor driven and incorporates various features discovered from experience with the first machine. At the same time, good quality paper with a latex backing and low tack adhesive also became available in widths up to 48 in.

Polished sheets covered with the protective mask on the slatted conveyor

The motor-driven laminating machine can deal with the widest sheets now manufactured up to any length. Firth-Vickers can cover sheets up to 48-in. wide with the paper tape in one strip or with PVC in two strips. The width of the PVC tape is governed by the present supply of film to the tape manufacturers, but it is understood that tape up to at least 36-in. wide will eventually be available.

Although these two protective materials provide suitable protection against most forms of damage, there is doubt about their suitability for press work. The best compromise at present seems to be for protected sheets to be used up to the stage of the cut blanks being pressed. This ensures that up to that moment the blanks are free from scratches and abrasions. The protective tape should be removed at this stage and pressing proceeded with using either a loose thin sheet of polythene or some press lubricant to minimize scoring by the press tools. The results from using thin polythene film for this purpose seem to be encouraging and the possibilities are being explored of producing a thin adhesive tape having the protective characteristics of PVC with the greater plasticity of the polythene. Such a tape could then be used both for protection in handling and through the press operations.

The motor-driven laminating machine has been incorporated in the inspection conveyor line at Firth-Vickers so that the tape protection can be applied immediately after the sheets have passed inspection. This avoids the possibility of any damage being incurred and of the sheets getting dirty between inspection and despatch.

After passing through the laminating machine, the speed of which is synchronized to match that of the inspection conveyor, the sheets pass on to a further conveyor for cutting to final size, packing and despatch.

CHANGE OF ADDRESS

THE GENERAL STEEL AND IRON CO. LTD. have opened West End offices at 30-32 Mortimer Street, London, W.1. Telephone: MUSeum 8471-3. Cables: Stelirne, London, W.1. Telegrams: Stelirne, London, Telex.

APPOINTMENTS and STAFF CHANGES

The Minister for Science, Lord Hailsham, has appointed five new members of the **Council for Scientific and Industrial Research.** They are Mr. L. H. Bedford, director of engineering, Guided Weapons Division, English Electric Aviation Ltd.; Mr. G. B. R. Feilden, F.R.S., managing director, Hawker Siddeley Brush Turbines Ltd.; Professor E. R. H. Jones, F.R.S., Waynflete Professor of Chemistry, Oxford University; Professor O. A. Saunders, F.R.S., Professor of Mechanical Engineering, Imperial College, London; and Mr. H. C. Tett, chairman and managing director, Esso Petroleum Co. Ltd.

Three members who have completed their five-year term of office have retired: the former chairman, Sir Harry Jephcott, chairman of Glaxo Laboratories Ltd.; Professor C. E. H. Bawn, F.R.S., Professor of Inorganic and Physical Chemistry, Liverpool University, and Sir Willis Jackson, F.R.S., at present Director of Research and Education, A.E.I. (Manchester) Ltd. A fourth member, Sir Walter Drummond, who was also due to retire in September, has been reappointed for a period of three months.

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At the annual general meeting of the **British Standards Institution,** Mr. Geoffrey Cunliffe, managing director of Norcros Ltd., was elected president of the B.S.I. in succession to Mr. R. E. Huffam. Mr. Cunliffe had earlier been elected chairman of B.S.I.'s General Council.

Tributes were paid to Mr. Huffam for his three years' service as president of B.S.I. and chairman of its General Council. He was elected a deputy-president. Sir Herbert Manzoni (City Engineer of Birmingham) and Mr. John Ryan (vice-chairman, Metal Box Co. Ltd.) were re-elected as deputy-presidents.

Mr. A. D. Bonham-Carter, United Kingdom co-ordinating director of Unilever Ltd. succeeds Mr. Cunliffe as chairman of B.S.I.'s Finance Committee. Also announced was the appointment of Sir Anthony H. M. Bowlby as chairman of B.S.I.'s Engineering Divisional Council in succession to Sir Stanley Rawson, whose term of office had expired.

Mr. G. C. Bateman of Robat Engineering, Birmingham, in conjunction with Mr. L. W. Power, has been appointed midland representative for **Pearson Panke Ltd.,** specialists in a comprehensive range of presses and sheet metal working machinery.

* * *

The Council of the **Industrial Welfare Society** announce the appointment of Mr. John Garnett as the Society's third director in its 43 years existence. The vacancy arose earlier this year when Mr. John Marsh, who in 1950 succeeded Sir Robert Hyde, the Society's founder and first director, accepted an invitation to become director of the British Institute of Management.

* * *

The British Iron and Steel Federation announce the following appointments:

Mr. E. W. Senior, C.M.G., as director of the Federation; Mr. J. B. Cowper as managing director of British Iron and Steel Corporation Ltd.—the industry's main central trading organization—in addition to his present post of financial director of the Federation; Mr. J. Driscoll as assistant director (economics), Mr. L. J. Gollop, assistant director (statistics); Mr. B. S. Keeling, assistant director (training); Mr. A. H. Mortimer, assistant director (commercial); and Mr. K. Donohue, Secretary of the Federation.

* * *

Mr. L. Colkett, Mr. K. C. McCarthy and Mr. G. H. Thornley have been appointed directors of **Castrol Limited,** parent company of the Castrol Group.

The new directors, who have a combined total of 94 years service, will continue to occupy their executive positions with the company.

* * *

Two new appointments to the board of **Black and Decker Ltd.** are Mr. J. C. Brooman, F.C.A.—export sales director, and Mr. E. A. King, A.C.A.—financial director. Mr. Brooman joined the company in 1952, Mr. King in 1954.

Also announced are the appointments of Mr. J. H. Longland as sales manager in the United Kingdom and Mr. R. K. Symmons as marketing manager.

Mr. William H. Rigg, B.Sc.

Mr. William H. Rigg, B.Sc., has been appointed managing director of **Firth Cleveland Tools Ltd.,** a member of the Firth Cleveland Group. He will operate from the Company's Tipton Works in Staffordshire.

The activities of Firth Cleveland Tools Ltd. extend from the manufacture of Surform hand tools and power tool accessories at Tipton to the production of high precision machine and press tools, located at the Company's two Wolverhampton Works. As managing director of Revo Electric Co. Ltd., for the past three years, and associated for many years with the Duport Group of Companies, Mr. Rigg brings to his new post a wide knowledge of tooling technology.

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The acquisition of Star, the Italian electrical power tools company, by **Black and Decker** has now been completed, and the new board of directors of Star Utensili Electrici S.p.a. is:

Mr. Robert Appleby, president (English); Signor Mario Consiglieri, director and general manager (Italian); Monsieur Francois Mertens, administrative director (Belgian); Mr. A. G. Decker, Jr., director (American); Mynheer R. Ceurvorst, director (Dutch); and Avv. Luigi Lillia, director (Italian).

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Mr. P. D. Kelly, laboratory technician from the Dublin sales office and factory of Coates Bros. (Ireland) Ltd., recently transferred to **Coates Bros. (East Africa) Ltd.,** one of the Coates group of printing ink manufacturing companies. He will work in the Nairobi laboratories.

* * *

The **Brockhouse Organization** announce the appointment of Mr. G. H. Woods as sales and commercial manager of **Thomas Chatwin and Co.** Mr. Woods has had 30 years experience in the small tool industry and was formerly commercial manager of the B.S.A. Small Tools Division.

(*Continued in page* 927)

Appointments and Staff Changes

(*Continued from page 926*)

Mr. R. G. Monkhouse, manager of the central engineering workshops at **The United Steel Companies'** Workington Iron and Steel Company branch has been appointed works manager (Ickles) at the Steel, Peech and Tozer branch.

* * *

The **Council of British Manufacturers of Petroleum Equipment** announce the appointment of Mr. R. A. Pittman, B.Com., F.C.I.S., as deputy director, a new position which the Council's increasing membership and activities has rendered necessary.

Mr. Pittman joins the Council after 14 years' service with the British Engineers' Association, as its secretary since 1956, being previously economic adviser to the research department.

* * *

Sir Ivan Stedeford, G.B.E., chairman and managing director of **Tube Investments Ltd.,** has relinquished the managing directorship, while continuing as executive chairman.

Sir William Strath, K.C.B., Mr. W. Hackett, Jnr., and Mr. R. D. Young have been appointed managing directors of the Group.

J. W. Menter, M.A., Sc.D., F.Inst.P., has been appointed director of the Tube Investments Research Laboratory at Hinxton Hall, near Cambridge.

Mr. J. D. Dunlop, M.C., B.A., has been appointed managing director of the Tube Investments subsidiary, **New Conveyor Company Ltd.** of Smethwick, designers and manufacturers of mechanical handling plant and conveyors.

"GOLIATH" TRADE MARK

URQUHART MACHINE TOOLS LTD. of 60 Tabernacle Street, Finsbury Square, London, E.C.2, announce that the Trade Mark "Goliath" under which the well-known range of shearing, cropping, bending and punching machines have been marketed both in this country and overseas for the last 20 years, has now been registered as a Trade Mark (Nos. 802687/8).

"Goliath" machines are being manufactured at their new works at Kingston-on-Thames from the original patterns, so that interchangeability of parts is ensured and spare parts can be supplied for even the earliest models.

ASTM CHANGES NAME

THE name of the American Society for Testing Materials has been officially changed to the American Society for Testing *AND* Materials with the signing of a court decree in September, 1961, amending the Society's Charter originally granted in 1902 by the Commonwealth of Pennsylvania.

The change in name is the result of study and discussion with members throughout the country extending over several years. It was also given careful consideration by the ASTM board of directors prior to its approval and adoption by the membership at the Annual Meeting, June, 1961.

A COURSE IN APPLIED PNEUMATICS

THE first "Course in Applied Pneumatics" was recently held at Farnham, Surrey. The course, which is sponsored by "The Journal of Applied Pneumatics", the house journal of Martonair Ltd., was attended by twenty students from all parts of the country, who heard lectures upon Compressed Air Theory, Circuit Design, Mechanism and Machine Design, Equipment Design Maintenance, Hydro-Pneumatics and other topics. A works visit and practical sessions were included.

Further courses are being held on March 5 and 26, 1962, and vacancies exist on a course commencing on April 16, 1962.

Forthcoming Events . . .

December 5

The Institution of Plant Engineers (Peterborough Branch). "Non-Destructive Testing" by F. Hinsley, F.I.M., at the Conference Room of F. Perkins Ltd., Peterscourt, Peterborough. 7.30 p.m. (Joint meeting with the Institution of Production Engineers).

December 7

Liverpool Metallurgical Society. "The Explosive Forming of Metals," by Dr. H. Thomas, in Department of Metallurgy, The University of Liverpool, Liverpool 3. 7.0 p.m.

December 11

Lincolnshire Iron and Steel Institute. "Developments at Lysaght's Rod Mill since 1951," at the North Lindsey Technical College, Kingsway, Scunthorpe. 7.30 p.m.

December 13

North Wales Metallurgical Society. "Radioisotopes in Metallurgy. Some Recent Techniques and their Industrial Applications," by Dr. D. H. Houseman, at Lecture Theatre, Flintshire Technical College, Connah's Quay, Nr. Chester. 7.0 p.m.

The Institution of Plant Engineers (Western Branch). "Safety in Factories," by J. B. Taylor, at the Grand Hotel, Broad Street, Bristol. 7.15 p.m.

OBITUARY

Marbaix. We regret to announce the recent death of Mr. Gaston E. Marbaix, well-known importer and manufacturer of machine tools. He was 70 and had taken an active part in business affairs until shortly before his death.

Mr. Marbaix established the business of Gaston E. Marbaix Ltd. in 1915 and has represented at home and abroad many American and European machine tool makers. During the Second World War, his company handled American machine tools and distributed small tools under lease/lend, and during the UK rearmament programme in 1949 played their part in the importation of American machine tools.

A few years ago, Mr. Marbaix started the manufacturing side of his business, taking over a factory in South-West London. With the expansion of business, he formed four companies to handle each specific section.

MacMillan. We regret the passing on November 8, of Mr. Robert Davidson MacMillan, managing director of Controlled Heat and Air Ltd. (a member of the Incandescent group of companies).

Robert MacMillan was born in Glasgow in 1903 and received his technical education at Glasgow Technical College. He served his apprenticeship with A. and J. Inglis Ltd., marine engineers and ship builders, and became a qualified marine engineer, and in 1927 joined the Pneumatic Conveyance and Extraction Co. of Manchester, and later the Carrier-Owen Engineering Co. Ltd., London.

In 1933 he joined Controlled Heat and Air Ltd. as chief designer, and was appointed managing director in 1945. During the period of his office the company and the group with which he was associated made continuous progress.

Publications for Industry

The fourth of the books published by Alcan Industries Ltd. on bodybuilding in aluminium, has been issued, bringing up-to-date the information in their previous series, entitled "Light Alloy Bodies", which has been in use by bodybuilders for some years.

Book 1 deals with materials and general practice, Book 2 with platform and truck bodies, Book 3 with pantechnicons and box vans and Book 4 with tippers.

Copies of these books, also wall-charts showing aluminium sections and castings for bodybuilding, can be obtained from any of the sales offices of Alcan Industries Ltd.

* * *

Several operations occurring simultaneously at widely separated locations on view by your desk whenever you wish . . . By providing a means of visual inter-communication for industrial, commercial and scientific uses, closed-circuit television installations are to-day saving time and money throughout the world. This is the theme of a new pamphlet just published by E.M.I. Electronics Ltd.

With the ever-increasing number of applications for closed circuit television—over 90 are listed in another recently published book by E.M.I.—the variety of ancillary equipment grows. This equipment, varying from remote iris control equipment to camera acoustic housing, is the main subject of this new book. Sensibly arranged, with illustrations and ample technical specifications, the book includes an article on "How E.M.I. closed-circuit television works"

Both pamphlet and book are obtainable from E.M.I. Electronics Ltd., Instrument Division, Hayes, Middlesex.

* * *

At a time when the Chief Inspector of Factories' report just published shows last year's total industrial accidents 190,266—16,195 more than the previous year—675 ending in death—a new edition of "Safety and Health in Industry" is being made available without cost.

The seven major sections of this 150-page publication with over a hundred photographs, diagrams, charts, and other illustrations cover: (1) Machine Guarding, (2) Industrial Health Engineering, (3) Personal Protection, (4) Material Handling, (5) Housekeeping and Maintenance, (6) Fire Protection, (7) General Section.

In a "down to earth" foreword to the publication deploring the rise in accidents, Former Deputy Chief Inspector of Factories, R. Bramley-Harker, calls for "*something more*".

He lists—among his suggestions—Plan a Safety Campaign; Job Training; Foreman Training in Safety; Plan a Safety Code; Organize a Top Hat Safety Course for the "Top Brass"; Tighten Discipline. He concludes his foreword with the thought-provoking: "*A positive direct action is required—if it is not made—no decrease in accidents will occur nor can be expected*".

This book has been produced primarily as an easy-to-read guide on basic Safety, Health and Welfare in Industry and is particularly useful to the foreman, works manager, or executive, anxious to prevent the loss to industry of some 20,000,000 man days annually. Strikes and disputes cost only a seventh lost time as do accidents.

Copies of the book are available without cost from The Industrial Health and Safety Centre, 97, Horseferry Road, Westminster, London, S.W.1.

* * *

That minds matter as much as machines in the training of young engineers is one of the points emphasized in an article on apprentice training which appears in the October/December edition of "The Forge", quarterly journal of the Brockhouse Organization.

The issue also contains an illustrated feature on the new mechanized moulding plant installed at one of the Group's Midland foundries, and gives details of a new and revolutionary breakdown recovery unit, developed by another subsidiary company, which was exhibited for the first time at this year's Motor Show at Earls Court.

Other features include a pictorial survey of some of the varied industrial and commercial establishments using oil-fired heating, and reports of Group activities at home and abroad.

* * *

Anti-friction linings of turbines must be securely bonded to their iron supporting shells. An article in "Tin and Its Uses" No. 53 describes in detail the techniques of tinning the shells and casting the tin-base anti-friction linings into them.

The improved quality of bronze rods and tubes made by the continuous casting method developed at the Tin Research Institute has led to the adoption of this method by bronze founders in many countries.

Organic compounds of tin are now being manufactured on a large scale in the U.S.A. for use in plastics, for wood preservation and for many more purposes, including the disinfection of hospitals and hospital sheets and blankets. In this issue, appears an illustration of a very big plant for making organotin chemicals at Carrollton, Kentucky.

The fouling of ship bottoms while the ships are at anchor has to be combatted by means of anti-fouling paints and treatment. A recently developed method for doing this consists in ejecting a fine spray of organotin chemical under the keel when the ship is in harbour. The treatment completely suppresses marine growths and effects large savings in the amount of oil needed for propulsion.

"Tin and Its Uses" is available, free of charge, from Tin Research Institute, Fraser Road, Perivale, Greenford, Middlesex, or any T.R.I. offices overseas.

* * *

The section concerned with heat- and corrosion-resisting materials forms an interesting feature of the September issue of "The Nickel Bulletin". Attention is drawn to papers reporting corrosion tests on nickel-containing steels in Canadian and tropical atmospheres, and to recent literature covering studies carried out to determine the mechanical properties of stainless steels and the resistance of various nickel-containing materials in specific corrosive media. Worthy of particular note among the items relating to heat-resisting materials is a group concerned with specifications for, recent developments in, and work on, nickel-base turbine-blading alloys.

Literature on nickel plating receives due consideration, and, in this connexion, attention may be drawn to items summarizing the salient findings of a comprehensive review of the present status of decorative nickel/chromium plating and outlining the scope of A.S.T.M. Specifications on corrosion testing and double-layer nickel coatings.

In the section on non-ferrous alloys, an outline is given of the requirements of B.S. 1400:1961 (which relates to copper-alloy ingots and castings) and compositional requirements are tabulated for all the materials included in the Standard. Of the items comprising the other sections, those relating to the properties of permanent magnet alloys and cast 9 per cent nickel steel may perhaps be singled out as of particular interest.

Copies are available from The International Nickel Co. (Mond) Ltd., Thames House, Millbank, London, S.W.1.

NEW PLANT and EQUIPMENT

A monthly review of new machines, equipment, processes, etc., of interest to the producer and user of sheet metal

Hydraulic Press

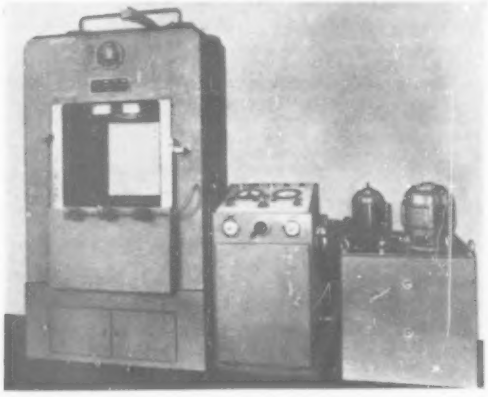
SACK AND KIESSELBACH G.m.b.H., Dusseldorf, Western Germany, have recently added a new press to their range.

The new model (Fig. 1) has been designed for coining, deep drawing and extruding of light and comparatively large components. For these purposes, a bed area larger in proportion to the press tonnage is needed than is the case with the standard cold hobbing and coining presses. Also, a positive automatic ram return and an automatic ejector are required. To meet these requirements, the new press has a bed 29 in. × 29 in. Maximum tonnage is 250. The power of the ram return and ejector is approximately 6 per cent of the selected working pressure. In common with their other models, this press is of the up-stroking type. Rapid approach speed of the ram is 3 in. per sec., the working speeds per sec. being 0.4 in. for pressure up to 50 tons and 0.1 in. above this tonnage. Return speed is 4 in. per sec. Maximum daylight is 23 in. and stroke 15 in.

Approximate weight of the press complete with control and pump units is 10 tons, and no special base is necessary.

Operating controls are situated in the unit interposed between the hydraulic pump unit and the press. To facilitate setting, the ram can be stopped at any point in its travel. To close the press, two switches must be operated simultaneously.

Fig. 1.—Hydraulic press



The ram return, ejection and return stroke of the ejector are automatically operated. An emergency stop button is provided to halt the cycle at any point.

The main guideways for the bed inside the uprights are protected by metal telescopic guards. The piston is also protected throughout its travel by guards attached to the front and rear of the bed.

Sole U.K. Selling Agents for Sack and Kiesselbach products are Rockwell Machine Tool Co. Ltd., Welsh Harp, Edgware Road, London, N.W.2.

Helical-Weld Aluminium Pipe

LARGE-SCALE production of aluminium pipe in sizes up to 28-in. dia. is now possible, due to the successful adaptation to aluminium of the helical-weld method of tube making. Until now the two main types of aluminium tubing that were available in large quantities, extruded and drawn seamless tubing, have been limited by practical considerations to a maximum diameter of approximately 12 in. The method sometimes used to fabricate large diameter pipes, by bending plates into cylindrical shapes and welding them longitudinally, does not always lend itself to large-scale production.

The method of making helical-weld tube consists essentially of feeding metal strip into formers or a series of rollers set at an angle so that the strip describes a helix as it travels through the machine. The resulting helical seam is then welded continuously and automatically. The tubing can be made in very long lengths and to accurate limits.

The process was first developed for steel pipe at the end of the last century but it took many years of improvements in strip quality, in automatic welding techniques, and particularly in continuous weld testing and quality control, before the production of consistently high-quality helical-weld pipe became a practical proposition. Because of the increasing demand for thin-walled aluminium pipe in large diameters, Alcan Industries Ltd. (then Northern Aluminium Company), undertook in 1959 in collaboration with makers and operators of helical-weld equipment, a programme of development work on the production of helical-weld aluminium tube. The close tolerances to which aluminium strip is supplied permit welding to take place under excellent edge matching conditions.

Helical-weld tubing is now being offered, in sizes from 6-in. to 28-in. dia. with wall thicknesses up to ¼ in., by three British companies: Apitubes Ltd., Bristol Aerojet Ltd., and The British Steel Piling Co. Ltd. Apitubes are producing pipe on helical-weld equipment designed and built at their Jarrow-on-Tyne works; Bristol Aerojet Ltd. have developed a different type of machine which produces helical-weld tube to exceptionally close tolerances for the

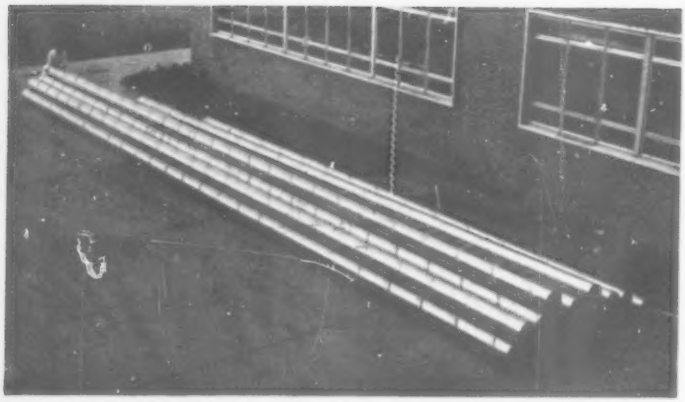


Fig. 2.—Helical-weld aluminium pipe

more specialized types of application; and The British Steel Piling Co. Ltd. are operating a "Driam" helical-weld machine at their Claydon Works, near Ipswich.

On the Continent at Oberhausen, near Dusseldorf, Intercontinental Enterprises G.m.b.H. are building their "Heliweld" plant. This equipment is capable of forming tube up to 120-in. dia. from strip up to ½-in. thick; it can therefore be used for making cylindrical vessels and tanks as well as tubing.

For all trials on helical-weld machines in this country Alcan Industries Ltd. advised on machine adaptation and supplied Noral strip up to ¼-in. thick in large coils of the higher strength alloys. Their associates, Aluminium Laboratories Ltd., Banbury, fitted the MIG and TIG welding equipment to the machines and established correct welding procedures.

All-steel Shear with Automatic Feed

THE Series 6216 Cincinnati shear (Fig. 3) equipped with automatic handling devices simplifies the cutting of ½ in. × 16 ft. long steel plates.

The front conveyors include a storage area and centring unit in addition to a lower feed table and overhead feeding arms.

Steel plates to a maximum of ½ in. thickness, 8 ft. in width and 16 ft. in length are delivered to the feed area by an overhead crane. As the material is fed through the shear, required blank widths are measured accurately with a power-operated back gauge.

Sheared pieces are discharged at the rear of the machine by means of a rear conveyor and scrap separating device. Floor-mounted controls interlock the machine cycle with the front and rear conveyor equipment for safe and convenient operation. Other features incorporated in this shear include hydraulic holddowns, ball transfers in the table, 48 in. back gauge range, power operated, and automatic pressure lubrication. Further information from the Cincinnati Shaper Co., P.O. Box 111, Cincinnati 11, Ohio, U.S.A.

Miniature 300 amp. TIG Torch

INTERLAS LTD., Ampthill, Bedford, announce a new Tec water-cooled miniature torch, which is claimed to have unlimited applications in confined areas, as small as 1½ in. in dia.

Torch head height including transparent Vycor nozzle is only 1¼ in. and uses a tungsten electrode 1½-in. long. It will accommodate tungsten diameters of 0.010 in., 0.020 in., 0.030 in., 0.040 in., 1/16 in., 3/32 in., and ⅛ in. inclusive.

Although small, the Tec miniature is capable of welding up to 300 amp. continuous duty cycle. It weighs approximately 2.4 oz. and has an overall length of 6¼ in.

It includes the proven feature of tip-of-the-torch cooling, transparent gas nozzle and sturdy one-piece construction.

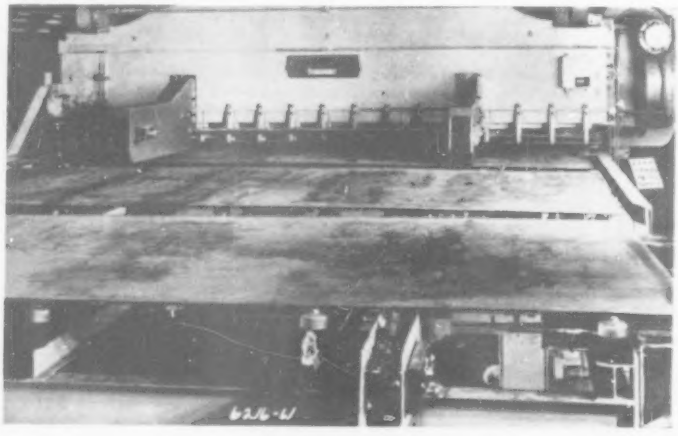


Fig. 3.—Steel shear with automatic feed

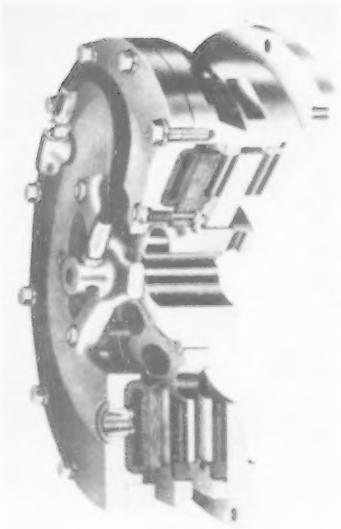


Fig. 4 (left).—Air-tube disc clutch

Fig. 5 (right).—Blowpipe for cutting or welding

Clutches and Brakes

A COMPANY recently registered in this country under the title of Wichita United Ltd., Basildon Industrial Estate, Essex, has been set up to undertake the manufacture and sale of "Wichita" clutches and brakes for Europe and British Commonwealth, excluding Canada, but including South Africa.

These clutches and brakes have a wide range of application, and problems of speed, smoothness and frequency of engagement or disengagement with all types of loads, problems of tension control, of braking without overheating and many other problems of this nature can be solved, it is claimed, by their use.

The Air-Tube disc clutch (Fig. 4) combines, it is claimed, features of the disc-type clutch with the advantages of direct air engagement; pressure applications is by compressed air in a rubber tube.

The Neoprene tubes reinforced with nylon used carry no torque and apply axial pressure only. They are insulated from heat generating surfaces by moulded asbestos pressure plates bearing moulded ribs that form centrifugal blowers—drawing cool air in at the centre and discharging it at the periphery. This type of tube eliminates packings, pistons, diaphragms and also linkage of mechanical clutches.

All torque is carried between the friction discs and the cast-iron floating plates. Releasing springs fitted between the plates ensure complete disengagement and allow no drag at all.

The clutches and brakes are manufactured in four main designs: standard ventilated, special ventilated (this is for high heat dissipation), low inertia and water cooled.

The complete range starts from a single plate 6 in. (friction disc dia.) giving a torque rating of 2,325 in. lb. at 100 lb. per sq. in. air pressure, and estends to a double plate 48 in. which will give a torque of 1,650,000 in. lb. at 100 lb. per sq. in.

These clutches and brakes are employed on refractory producing presses and extruders, in earth moving and construction, on such equipment as drag lines, scrapers, cranes, etc., in metal-working and processing equipment of all kinds including pay-offs, rotary flying shears, recoilers, presses, wire straighteners and benders, etc.

Blowpipe for Cutting or Welding

AN entirely new type of blowpipe is now available which by a simple change of nozzle can be converted from a cutting torch into a welding torch. Claimed to be the only torch of its type available in Britain (Fig. 5), it does not require any conversion at the bottom of the shank. In addition back-firing has been eliminated.

Called the Double Duty Demon, it weighs only 1¼ lb., and is simple to manipulate. It will cut sheet metal and steel plate up to 2 in. thick, and can weld steel up to ½ in. thickness.

The handle to the torch has been specially designed and constructed being of non-metallic composition with a non-slip fluted grip. The torch is supplied with three welding and two cutting nozzles which will handle most of the requirements of everyday welding and cutting. The blowpipe is marketed by Suffolk Iron Foundry (1920) Ltd., Sifbronze Works, Stowmarket.

Phosphating Process

THE Paints Division of I.C.I. has developed and introduced "Kephos" (Patents pending), a non-aqueous phosphating process which dispenses with rinsing and tank-heating, forms no sludge in the processing tank and produces a sealed phosphate coating. This coating is claimed to enhance paint adhesion and resistance to rust creep in the same way as conventionally produced zinc or iron phosphate coatings. The improvement in the corrosion resistance of paint systems is quite outstanding and the possibility of work being contaminated by water-borne impurities is eliminated.

"Kephos" contains a scaler which is sufficiently corrosion-resistant to protect work during transport or

temporary exterior storage for up to a week, or indoor storage up to six months. Under normal production conditions, work can be welded through the "Kephos" film. This enables items to be treated before fabrication, so that shrouded areas such as interior box sections receive some protection.

"Kephos" is not confined to dipping. It may be applied by brush, roller, spray or flow-coating, the most suitable method depending entirely on the characteristics and number of the articles to be treated.

The process can be used to supplement existing phosphating facilities when an article is too large for the plant or an abnormal volume of work requires processing. For regular use its higher chemical cost is offset by the compactness and simplicity of plant requirements and the saving in heating and plant maintenance costs, particularly for the manufacturer of a small volume of high quality production. The ideal system is to degrease all work on arrival and apply "Kephos" before it is put in store; it is thus simultaneously protected and phosphated during storage and subsequent assembly, requiring only the removal of surface dirt to prepare it for painting.

Multiple Turret Punching Presses

TWO new models have been added to the Edel range of multiple turret punching presses (Fig. 6). These machines, the model SM4/500/12 and the SM15/500/18 have been specially developed for the manufacture of radio and transmitter chassis, switchboards etc., and enable sheets to be punched accurately and with the minimum cost. The SM4/500/12 has a pressure of 4 tons with a 19¾ in. depth of throat, and is equipped with 12 tools in the turret head to punch holes up to $\frac{13}{16}$ in. diameter in 16-s.w.g. sheet, or up to $\frac{1}{2}$ in. diameter in 12-s.w.g. The SM15/500/18 punches holes up to 3½ in. diameter with a punching pressure of 15 tons, and a throat depth of 19¾ in., and carries 18 tools in the turret head.

When using a template, a hole is engaged by a selector pin which makes electrical contact, and immediately puts the magnetically-operated clutch into action so that the requisite hole is punched. For the one-off job the table is set by means of graduated scales.

Drawings can be used as templates with the aid of a needle-sharp pointer, and in this case the electrical contact, located directly on the handle, is operated by hand. A safety device prevents unintentional duplication of punching. Special adjustment is provided and built into each station of the turret head so that should a completed workpiece or tool with a number of punches not be accurately centered, the locking mechanism of the station can be adjusted either to the left or right until the work-piece is accurately centered in the co-ordinating system.

The table itself is mounted on the sub-base of the machine, the bottom slide carrying the top slide and running transversely. The top rolling slide is located laterally to the machine, and carries the workpiece which is clamped to the table by means of eccentric levers. The clamps can be adjusted laterally as required, and the material to be punched is clamped in such a manner that it is also possible to punch the rear edge of the sheet. The table platen on which the template or drawing is clamped also carries both slides, so that the stops for the workpiece and the template can be accurately set in the zero position of the co-ordinating system. Template tables are available in three sizes: 24 in. × 20 in., 40 in. × 20 in. and 50 in. × 26 in. The machine head is of all-steel fabricated construction.

Drive is taken from a star delta motor to a balanced flywheel, through transmission shafts running in roller bearings to a completely enclosed gear reduction, which drives the eccentric shaft operating the ram. The gear reduction equipment runs in an oil bath, and the eccentric shaft is mounted in special bronze bearings. The ram is

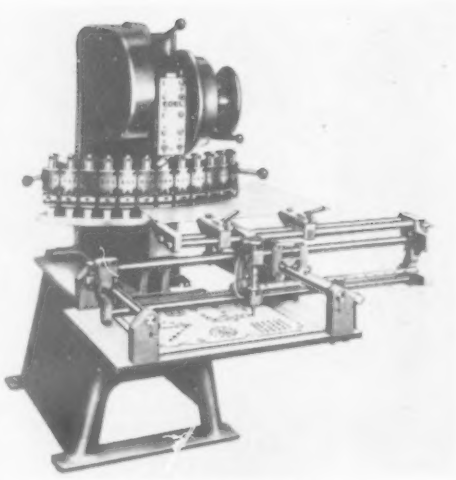


Fig. 6.—Turret punching press

hardened and ground, and the extra long ram guides are adjustable. The machine is controlled by a multi-tooth dog clutch which is hardened and ground. The ram can be raised and lowered by handwheel, with or without the motor running, so that it is possible to set the appropriate punches and dies efficiently and correctly.

Typical operation times are as follows: setting and punching one hole to exact measurements, from 12 to 21 seconds; punching by means of template, from 1 to 2 seconds according to the size of the machine. Resetting the turret head to suit a different type of tool takes from 3 to 6 seconds. A 30-in. × 20-in. plate can be punched successively with 12 tools, comprising 95 punchings with 12 adjustments of tools, in a total time of 5½ minutes. Punching accuracy on these machines is ± 0.004 in.

Sole concessionaires in the United Kingdom are F. J. Edwards Ltd., 359-361, Euston Road, London, N.W.1.

Automatic Tube Bending Machine

THE Curvatubi B.20, the smallest model of a new range of tube bending machines introduced by Pressbend Ltd., 28, Marshalsea Road, London, S.E.1, is characterized by the same fully automatic features that are on larger machines, but sells at an extremely competitive price. The machine is automatic electro-hydraulic, and has a 6-angle of bend preselector. The range of this model is up to $\frac{7}{8}$ in. outside dia. tube, and it is therefore suitable for the production of metal furniture, domestic appliances, heating and refrigerating equipment, toys and cycles, as well as motor-car accessories.

Standard features are the automatic mandrel retraction as well as automatic mandrel lubrication. The hydraulic system is used for clamping, bending, return of bend (accelerated speed) pressure slide clamping, and allows for fine adjustment of clamping pressure and bending speed, and enables, therefore, accurate repetition bends. The machine is capable of doing up to 700 bends per hour.

The advantages claimed for this machine are: automatic clamping of the material; automatic release of the material; automatic closing and opening of the pressure rolls; variable control of bending speed; accelerated return of the bending head; automatic mandrel retraction device; and automatic mandrel lubrication device.

(Continued in page 934)

NEW!

The Wolf TS35c $\frac{5}{8}$" Capacity TWO SPEED General Duty Drill

COMPETITIVE—LOW 'WEIGHT : CAPACITY' RATIO—PRESS BUTTON SPEED CHANGE

This is the machine for high efficiency drilling on any type of work. The touch of a button changes speed from 550 r.p.m. to 1,350 r.p.m., reducing change-over time on jobs to a minimum, and an adequate power reserve ensures that correct drilling speeds are maintained. The low weight and good balance of the TS35c make it a very easy drill to handle—check with your operators on that score—and the competitive price, allied to high output, will appeal to your pocket.
There's much more to the performance of TS35/35c we would like to tell you—so send for the detailed leaflet which has all the facts and figures of interest to you.

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2 SPEEDS
550 R.P.M. **1,350** R.P.M.

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Figs. 7 (left) and 8 (right).—Flexible couplings

Flexible Couplings

TWO new couplings—Cardeflex (Fig. 7) and Elsi (Fig. 8)—have recently been added to the well-known-range of flexible couplings available from J. H. Fenner and Co. Ltd. of Marfleet, Hull.

The scope of all-metal Cardeflex extends from fractional horse-power up to 90,000 h.p. at 330 r.p.m., while Elsi is a safety slipping coupling embodying all the flexible characteristics of Cardeflex.

Where very-high-speed running is required, Cardeflex is available with steel flanges. Other special designs supplied on request include a coupling incorporating a brake drum, a model for sustaining and thrust, and another included in a flywheel.

Elsi-Hydrostar is another special coupling which has all the features of Elsi plus the advantages of hydraulic de-clutching.

Catalogue 590/21 gives complete details of all these couplings and technical advice will be freely given on application to the makers at the above address.

Semi-Tubular Rivets

A NEW range of drilled, semi-tubular rivets is now being produced by Cooper and Turner Ltd., Vulcan Road, Sheffield, 9. These rivets are in mild steel, copper, brass and aluminium alloys to British Standards Specifications and particularly to special order as for example where special head shapes and sizes are required.

The size range is from ¼-in. to ⅝-in. dia. and up to 6½-in. in length.

Monochromatic Light

THE well-tried technique for checking surface flatness to an accuracy of one-millionth of an inch using an optical flat has been greatly facilitated by the introduction of the improved Lapmaster monochromatic light. Payne Products International Ltd., Slough, Bucks, are now marketing this unit.

The new model, which incorporates a high-voltage transformer in the light head, may be used on the bench, or fitted to a wall when tall components require examination. Fig. 9 shows an operator testing such a casting. The light source is a series of four helium tubes. In the event of damage, a defective tube may be bridged out of the circuit and the unit used until a replacement is fitted. The powerful monochromatic light can be used to assess widely varying degrees of flatness. No time is lost in reducing air wedge thicknesses above the surfaces to be tested. This eliminates wear on the optical flat.

Requiring a power supply of 220/240 v., 50/60 cycles, single phase a.c. the light head may be conveniently swivelled and locked in any position in a 200-deg. vertical arc. Individual voltages available to special order.

(*Continued in page* 936)

Fig. 9.—Monochromatic light

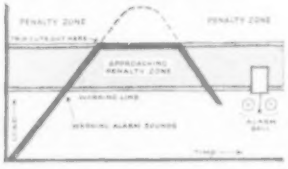
Load Factor Improvement

Most industrial electricity tariffs consist of a fixed charge based on the maximum demand for electricity by the works and a running charge for each unit (kWh) of electricity used. Broadly speaking, the fixed charge covers the capital cost of generating, transmitting and distributing equipment for the particular demand and the running charge covers the cost of generating the units.

Thus, if the factory maximum demand is reduced for the same level of consumption or is held constant for an increased consumption, the cost per unit will be reduced. This is termed mproving the 'load factor': load factor being defined as the ratio of the number of units supplied during a given period to the number of units that would have been supplied had the maximum demand been maintained throughout the period; it is usually expressed as a percentage. Some ways in which load factor can be improved are:

CONTROL OF MAXIMUM DEMAND

A maximum-demand alarm gives a warning when the maximum demand is about to be exceeded. One of the simplest devices has two warning contacts, but, as a useful addition, an auxiliary relay can be supplied so that non-essential load can be tripped automatically.



The Load Limiter, an automatic device, meets the requirements of medium and large consumers who wish not only to control their system loading to some target maximum but also to improve the load factor in order to increase the overall economy of the plant.

EXAMPLES OF REDUCTION IN MAXIMUM DEMAND

Broadly speaking, loads which contain some storage element can be transferred from on-peak to off-peak times. Examples are: charging electric batteries used in industrial trucks and road vehicles; pumping loads in drainage schemes; water pumping in quarries, gravel pits and other open-air workings; large cold-storage warehouses; ice-making factories in which cost of power is a sufficiently large item of the operating expense to make a reduced charge acceptable.

Many processes at times of peak demand can, under controlled conditions, tolerate a temporary reduction, or even cessation, of supply without any serious effect on the product. With electrochemical processes such as in the manufacture of hydrogen peroxide no difficulty arises from periodic interruptions at short or even no notice.

In a plastics factory the management arranged for dies to be switched on by time switches one after another early Monday morning so at the beginning of work all dies had reached their operating temperatures.

In a certain chemical works compressed air is used for blowing out containers for plastic material. The nature of this operation is such that the consumption of air is spasmodic and irregular. The demand-recording meter in this works showed that the 18 kW motor driving the air compressor was frequently cutting in on top of the factory load, thus incurring a higher maximum-demand charge. In this case all that was necessary was to ensure that the air receiver only required charging at night-time or at other off-peak times. It was found that the existing receiver had such a small capacity that the pump had to operate to recharge it almost every time the blowing operation took place. This small receiver was therefore replaced by a receiver of large enough capacity to maintain the blowing requirements over the peak periods without further charging.

For further information, get in touch with your Electricity Board or write direct to the Electrical Development Association, 2 Savoy Hill, London, W.C.2. Telephone: TEMple Bar 9434.

Excellent reference books are available on electricity and productivity (8/6 each, or 9/- post free)—'Higher Industrial Production with Electricity' is an example.

E.D.A. also have available on free loan in the U.K. a series of films on the industrial uses of electricity. Ask for a catalogue.

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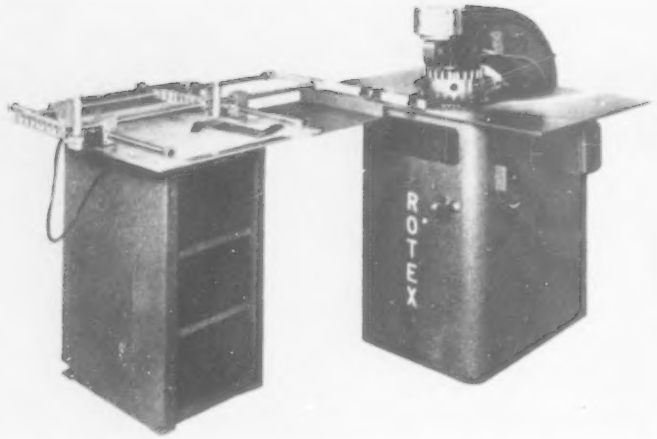


Fig. 10 (left).—Duplicating turret punch press

Fig 11 (below).—Back-geared dial-feed power press

Duplicating Turret Punch Press

THE Rotex Duplicating Turret Punch press (Fig. 10) is designed to punch production runs of chassis, panels, and other fabrications accurately, at high speeds, and at low cost.

Duplicate features include:

Press is capable of duplicating template hole locations within 0.005 in. at 20 strokes per min. Two-hand control of stylus movement ensures greater hole locating speed accuracy. Eighteen punch and die stations up to 2 in. round. Press can be operated without the duplicator by use of a foot switch. Approximately 10 tons of punching power. 18-in. or 24-in. throat depth available. Handles templates up to 18 in. × 24 in. Rotex quick change turret and die plate feature. Low capital investment.

The press is comprised of a modified Rotex hydraulic-operated turret punch press coupled with a precision duplicating table and assembly.

Standard equipment includes a full set of punches and dies, valves, cylinders, lubricators, stock clamps and stops, and electric equipment. The tapered stylus is also standard equipment. Other stylus types are available.

The duplicating attachment consists of a ground aluminium tooling plate, drilled and tapped for convenient template location; mounted on the surface of the table is an assembly consisting of stylus and actuator handles, hardened and ground traverse rods which run through recirculating linear ball bearings, a stock bar, stock clamps, and a stock stop. The assembly is designed so that X-Y movement of the stylus produces an identical X-Y movement of the workpiece. The duplicating "system" consists of four elements, two fixed, two movable, the stylus and workpiece which are linked together form the movable elements and the template and ram comprise the fixed element. The workpiece is rotated 180 degrees in a horizontal plane from the position of the template. This is a result of the relative positions of the duplicating table and the punch press, and the fact that the stylus is not directly connected to the ram which it represents in locating holes on the template.

The template is the key to accurate operation of this machine. It should be not less than $\frac{1}{4}$ in. plate. Since the stylus is tapered the plate must be thick enough to prevent the stylus from contacting the table top before it seats in the location hole. Each side of the template should be 90 degrees from its adjacent sides.

In operation the operator grips both the actuator and stylus handles and guides the stylus over the template. When the stylus is inserted in a hole, the workpiece is properly located for that hole and the operator depresses the button switch at the top of the left hand handle. The hole is punched.

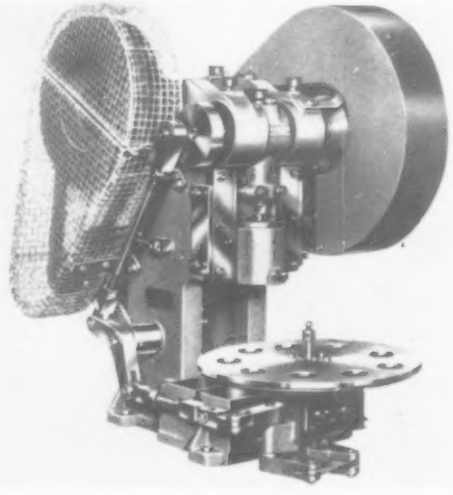
All holes of identical size should be circled and linked on the template by paint or die. Each hole size should have a separate colour code.

To rotate turret and die plate, the work must be removed from beneath the ram by moving the stylus off the template and following the standard procedure.

This press is available from the Sheet Metal Machinery Co. Ltd., Poyle Road, Colnbrook, Slough, Bucks.

Dial-feed Press

FIG. 11 shows the new 6-ton capacity back-geared dial-feed power press introduced by Jones and Attwood Ltd., Stourbridge, Worcester. The dial feed shown has nine stations and can be jig-bored to customers' requirements. The press is 36 in. high × 21 in. wide × 32 in. front to back and has an open tool height of 8 in. with a $4\frac{1}{2}$-in. throat. The bed size is 12 in. wide × $8\frac{1}{2}$ in. and the press is available with fixed strokes of $1\frac{1}{4}$ in., $\frac{1}{2}$ in. and $\frac{1}{4}$ in. The ram speed is 50 strokes per min.



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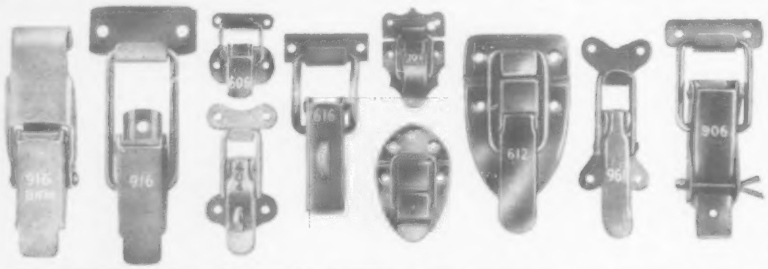

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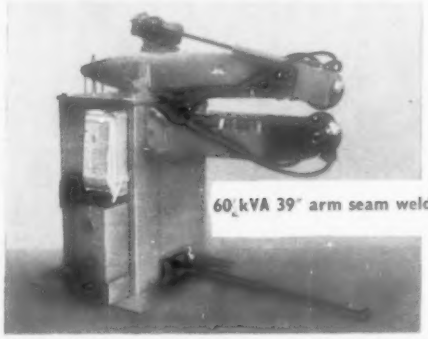

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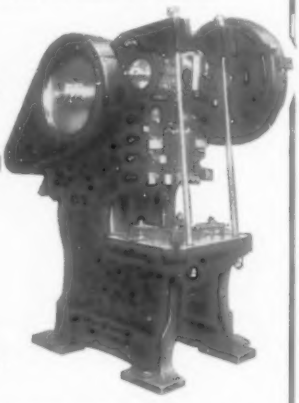

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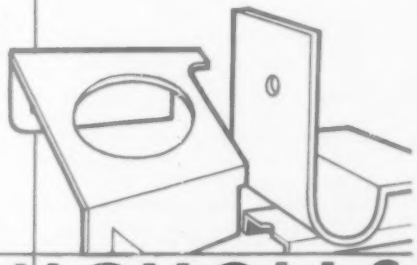

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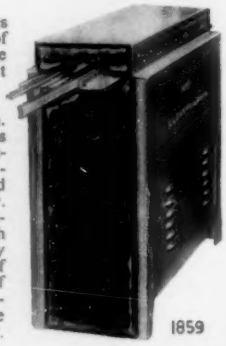

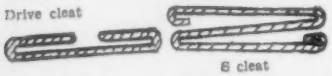

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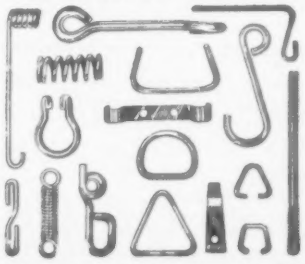

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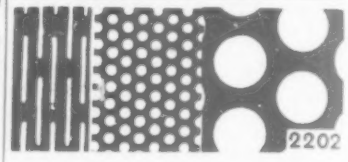

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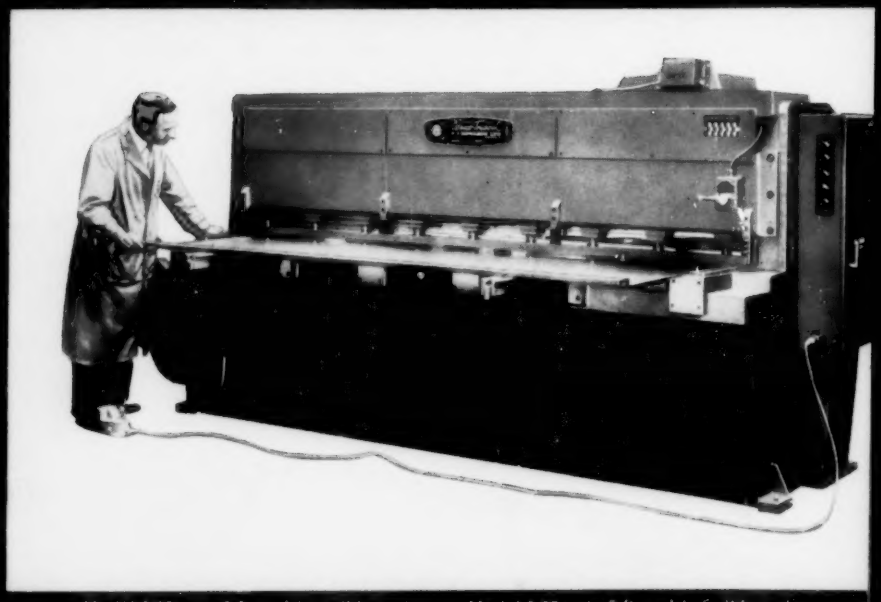

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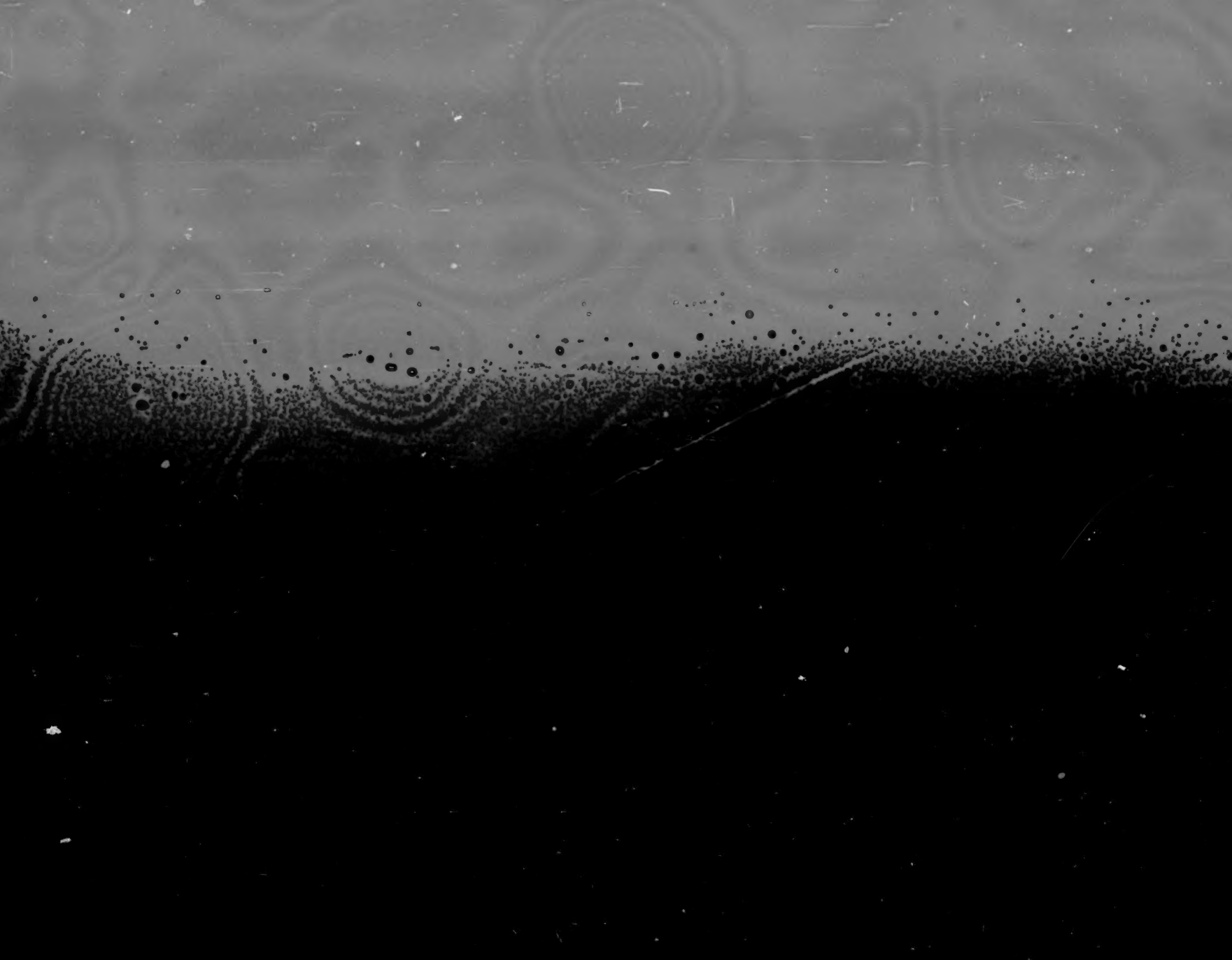
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